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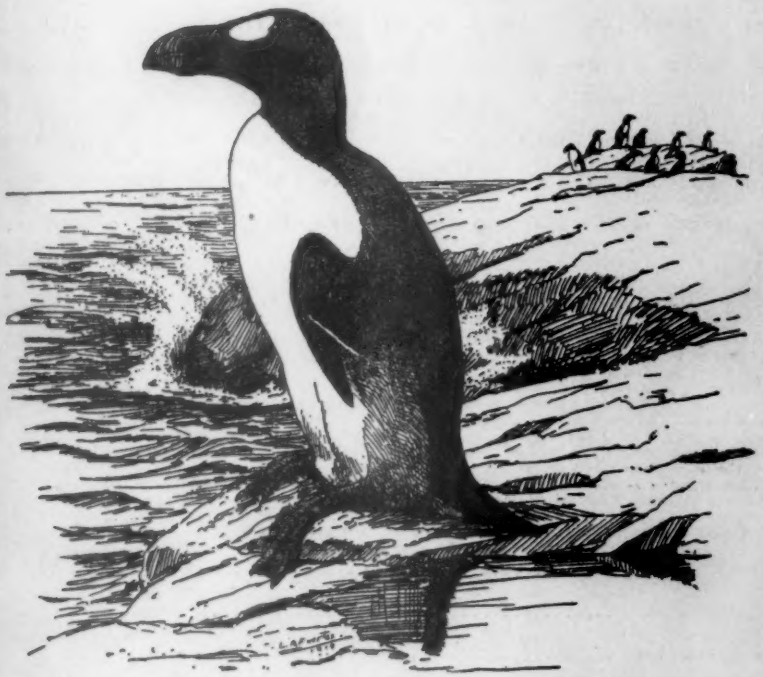

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Glover M. Allen

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IN MEMORIAM: GLOVER MORRILL ALLEN

BY WINSOR MARRETT TYLER

Plate 4

GLOVER MORRILL ALLEN, A.M., Ph.D., Fellow of The American Ornithologists' Union and Editor of 'The Auk,' died suddenly in Cambridge, Massachusetts, on February 14, 1942. His death brought to the Science of Zoölogy a grave loss, and to his friends a sadness which grows more and more keen as we realize that only our memory of him remains.

As we think back over his life, we seem to see two pictures: one, the eminent naturalist, admired, respected and honored the world over; the other, our beloved personal friend, quiet, humble, almost self-effacing, the epitome of modesty. It may be that Glover himself saw the two pictures, too. When he became Editor of 'The Auk,' someone congratulated him on his appointment. He smiled—his delightful, gentle smile—and said: "It seems hard to believe."

Glover Allen was born in Walpole, New Hampshire, on February 8, 1879, the son of the Reverend Nathaniel Glover Allen and Harriet Ann (Schouler) Allen. He prepared for college at the Newton (Massachusetts) High School, and as we enumerate below the further steps in his education we realize that he must have been a youth of exceptional promise and ability, driven on by a deep interest in his chosen field, Natural History.

He graduated from Harvard College, *magna cum laude,* in 1901, being elected to Phi Beta Kappa in his junior year. He received from the same University the degrees of A.M. in 1903 and Ph.D. in 1904, his doctor's thesis being "The Heredity of Coat Color in Mice." During his four years in college, in addition to taking courses in botany and zoölogy, he studied foreign languages, including even Russian and, in his spare time, Danish, acquiring thereby knowledge which was to be of inestimable value to him in later years. During 1906

and 1907 he attended the Harvard Graduate School and served as Editor of 'The American Naturalist,' and in the latter year began to work on the mammal collections of the Museum of Comparative Zoölogy. Thus, ten years after leaving high school, he was well launched as a professional naturalist.

Glover Allen's interest turned early to the study of Natural History. Even as a schoolboy he familiarized himself with the birds and mammals about his home in Newton and his summer home at Intervale, New Hampshire, and while still in high school joined the American Ornithologists' Union as an Associate. Before graduating from college he published, with Reginald Heber Howe, Jr., 'The Birds of Massachusetts,' a volume characteristic of the careful work of his later years; in 1903, he published in The Proceedings of the Manchester (N. H.) Institute of Arts and Sciences, 'A List of the Birds of New Hampshire,' which won high praise in a review by J. A. Allen, Editor of 'The Auk' (Auk, 21: 503–505, 1904). Upon graduation from college he was appointed Secretary, Librarian and Editor of The Boston Society of Natural History. When he retired from the office of Secretary in 1924, he was appointed Lecturer in Zoölogy at Harvard and Curator of Mammals in The Museum of Comparative Zoölogy, a position he held during the remainder of his life. In 1927 he was elected President of the American Society of Mammalogists and served for two years.

He was married on June 26, 1911, to Sarah Moody Cushing, who, with a daughter, Elizabeth Cushing (Mrs. Arthur Gilman), survives him.

In the course of his busy life, no more than outlined above, Dr. Allen travelled widely, studying the animals in many countries and collecting material for research. In 1903, he took a long cruise with Owen Bryant and Thomas Barbour in the northern Bahamas; in 1906 he visited Labrador with Dr. Charles W. Townsend; in 1909 he went to East Africa with Dr. William Lord Smith and Gorham Brooks; in 1910, with Professor C. T. Brues, he visited the island of Grenada in the West Indies; in 1912, with Dr. John C. Phillips, he went again to Africa and with a caravan travelled through the eastern Sudan along the course of the Dinder River and the Blue Nile; in 1926 he went with Richard P. Strong, Dr. George Shattuck, Dr. Joseph Bequaert, and Harold Coolidge to West Africa, visiting Liberia and the Belgian Congo; in 1929 he was a member of an expedition to Brazil; and in 1931 he travelled to Australia in the company of William Morton Wheeler.

In spite of his small stature and seeming frailness, Dr. Allen withstood the hardships of travel with surprisingly little discomfort and fatigue, and his associates, men of widely different personalities, agree that he was a delightful travelling companion, enlivening the journeys with his humor and stimulating the work with his enthusiasm and knowledge. Apparently he was happy on his travels, facing trials and even danger with a fortitude which almost amounted to indifference. He had a fondness for deserts. To him a desert was not barren, empty and dreary, but a place full of life, beauty and peace which would make an ideal, lifelong home.

Many of Glover Allen's friends associate him with the Nuttall Ornithological Club. The older members recall him, years ago, when he was Secretary from 1901 to 1906 and again from 1908 to 1912. At that time William Brewster was President, and the Club held its meetings in his museum on Riedesel Avenue, Cambridge. Allen, then a slim young man, sat on the right hand of the presiding officer and, always quiet and reserved but ever alert, harmonized with the dignified, almost solemn, atmosphere with which Mr. Brewster suffused the meetings.

In 1919 William Brewster died, and Glover Allen was elected President. Charles F. Batchelder, in his 'An Account of the Nuttall Ornithological Club' (1937), speaking of this period of the Club's history, pays Allen this high compliment: "Mr. Brewster's death marked the end of an era in the Club's history. Fortunately, a feeling existed that if the Club turned its face persistently toward the highest scientific standards, if it could find a leader who inevitably would maintain them, the members could be counted on to respond with even an increased devotion to its welfare. Such a successor to Mr. Brewster was found, and the Club's faith was justified. It elected a new President, one willing to spend precious time and strength for its interests, able to draw on unfailing depths of tact and of knowledge for the betterment of its meetings, inspiring it always to sounder and clearer thinking. Nearly twenty years have shown that under his guidance the Club can go on with utter confidence to ever increasing strength and usefulness."

As presiding officer of the Nuttall Club, Allen maintained the dignity of his predecessor, but with no hint of austerity, and brought to the chair a wide range of knowledge on many branches of Natural History. Many of those who remember both of the Club's presidents cannot fail to have noticed that Allen, evidently with William Brewster in mind, often used the very words which Brewster had been ac-

customed to employ when conducting the meetings, and we cannot doubt that Allen was paying a conscious tribute to the man whose place he had taken. His remarks in introducing a guest to the Club were courteous, easy and complimentary, and at the end of a paper he always spoke the tactful words which started the discussion in the best direction. How many times we have heard some one say on these occasions: "Glover always says exactly the right thing." But it was more than this, more than a studied, apt remark; it was an expression of honest interest, and, from his profound extensive knowledge, he frequently brought out tactfully some point which the speaker had overlooked.

Allen was a capable observer in the field; patient, absorbed in his investigation, he had the faculty of becoming inconspicuous when out of doors by reason of his quiet motions and his power to stand immovable. Years ago, when he was working on the small mammals of New England, he used to spend the Sunday morning hours on the westerly slope of Arlington Heights, not far from the famous 'Wren Orchard' of Frank Bolles (Allen lived in Arlington at the time). Often Mr. Walter Faxon and I would see him there, sometimes in the distance, wandering quietly away among the trees, following up the chipmunks whose life cycle he was studying from week to week. Oftener, perhaps, he would join us, always becoming interested at once in *our* observations.

It was delightful to travel in Allen's company; you learned much from his seemingly idle conversation along the way, about birds, mammals, insects, and geology, and he often quoted short scraps from the classics or an apt line or two of verse, all intermixed with quiet humor. Yet in some subtle way he gave you the complimentary impression that he was deriving pleasure from *your* companionship. On a short trip to Cape Cod, years ago, we spent the night at a hotel in Plymouth. In the darkness of our bedroom at the end of the day, someone walked heavily across the room above ours. Allen, almost asleep, murmured: "The Wild Ass stamps o'er his Head, but cannot break his Sleep."

Allen's memory was remarkable; his store of knowledge over a wide range of subjects seemed instantly available to him, often in the minutest detail. The habit which he followed for years of taking notes as he read doubtless aided his retentive memory.

Glover Allen's friend, Austin H. Clark, speaks thus of the extent of his knowledge of Zoölogy (Science, March 13, 1942): "Dr. Allen's interests were by no means confined to birds and mammals. He had

an extensive acquaintance with many other groups, particularly with their representatives in New England. This was not surprising in the case of other vertebrates, which are not numerously represented in New England, but to see him recognize certain rare insects in the field was surprising. Once in a bog at Essex he suddenly exclaimed, 'There is *Bombus borealis,*' and, sure enough, there was that rare little bumblebee flying about." Similarly, some years ago at Cohasset, where Allen joined a group of us to spend a day in the field, he arrived in the evening and immediately pointed out to us a rare foreign fly that was standing on the ceiling. And on the walk next morning he was the first to see a Mockingbird perched on the ridge-pole of a house.

On the resignation of Dr. Witmer Stone at the end of 1936, Glover Allen replaced him as Editor of 'The Auk.' With his familiarity with ornithological literature and his former experience as an editor, Dr. Allen was well fitted to fill this position. He brought also to the office an ability, rarely found in men placed in authority, yet of inestimable value in an editor or a reviewer, the ability to point out honestly and fearlessly defects in the work of other writers without wounding their feelings or arousing their antagonism. Many of Allen's reviews, masterpieces of tact and delicacy, show that he possessed this ability in marked degree.

Three works by Allen stand out pre-eminently, and assure him of lasting fame as a zoölogist. The following quotation from The Annual Report of the Museum of Comparative Zoölogy for 1938–1939 has reference to these volumes. "On May 15th a noteworthy celebration was held by the Staff of the Museum in recognition of the fact that three important volumes had appeared from Dr. Allen's pen during the course of the year. These were 'Bats,' a complete treatise regarding these animals from a consideration of the folk lore concerning them to their palaeontological history, a 'Checklist of African Mammals,' and a ponderous tome giving the results of his study of the 'Mammals of China and Mongolia.' "

Allen was not a popular man in the superficial sense; he had none of the hearty camaraderie of the 'jolly good fellow.' In fact many men who had known him for years felt a bit of restraint in his presence. To quote one of them: "All of us who were friends of Glover Allen had a very high regard for him, but at the same time there was always a little air of reserve that even his intimates could not penetrate, and made us wonder how much we really knew him after all."

It is true, no doubt, that Allen did shrink from expressions of inti-

macy, not, however, because of coldness in his nature or of indifference toward his friends, but because of the overpowering modesty of his character. He had none of the small talk of everyday intercourse; he never talked about himself, doubtless because, himself so modest, he did not think that such talk would interest anyone. He was ever ready, however, to express his opinion when asked for it, but never forward in advancing one, or combating the opinions of others. He felt, nevertheless, deep devotion for many of his friends, notably, among the older men, for William Brewster and Walter Faxon, and when he met a man for whom he cared, his face shone, alight with brilliant welcome. Many of us can recall some favor he did for us or some pretty compliment he paid us, all unostentatiously, as if he were pleasing himself.

The friendship he offered was the kind that the world seldom gives, built on the broad principles of Christianity, free from selfish interest, of a depth unguessed and therefore sometimes misunderstood.

1482 Commonwealth Ave.
Brighton, Massachusetts

SOME IRRELEVANT BEHAVIOR IN BIRDS[1]

BY A. L. RAND

IT has long been known that birds, when excited, sometimes behave in a manner which apparently has no bearing on the situation confronting the bird. A typical case is that of a bird flying up and singing when disturbed by an intruder near its nest. Huxley (Auk, 33: 142–161, 256–270, 1916) and Tinbergen (Amer. Midl. Nat., 21: 210–233, 1939) have brought together a number of examples of such behavior; the following are additional cases, illustrating its prevalence and some forms it may take.

One example is that of the incubating Pileated and Downy Woodpeckers (*Ceophloeus pileatus* and *Dryobates pubescens*) which, at the approach of a human intruder, threw chips from the nest cavities that contained eggs (quoted in Bent, U. S. Nat. Mus., Bull. no. 174: 49, 191, 1939). On one occasion this made an egg collector think that the nest was incomplete. As he did not then examine the nest more closely, and as at a later visit he found young in the nest, these actions had saved the eggs. The egg collector then suggested that

[1] A contribution from the Archbold Expeditions of the American Museum of Natural History, New York City.

this was a ruse of the woodpecker to deceive him, making him think the nest was being excavated.

During the past spring (1940) at Tucson, Arizona, I saw several examples of this type of behavior. The Vermilion Flycatcher (*Pyrocephalus rubinus*) furnished several of these. This species is strictly territorial. Once, when I invaded a territory, following the male from perch to perch, the male finally came, apparently by chance, into the immediate vicinity of the female. He then flew to the female and attempted (unsuccessfully) to copulate with her. This was after there were eggs in the nest and copulation would not normally occur. On several other occasions, when I disturbed a male in his territory, he gave his display flight and song. This could not always be evoked; it was more normal for him to retire from perch to perch.

Another example at Tucson was furnished by the Phainopepla (*Phainopepla nitens*). Approaching a nest containing eggs which I had occasionally visited, I saw the male a few feet above the nest. Usually when disturbed by my presence the bird simply flew away, scolding. On this occasion, however, on my close approach, the male flew to the nest, pulled out part of the rim and flew away with this material to the vicinity of the female, about thirty yards away. When I followed, he flew about, scolding. The nest was later deserted. This tearing down of a nest was a normal action, but the circumstances were abnormal. In this species, nest building plays a part in courtship. The male builds the nest. If he gets a mate, she may help with the completion of the nest; if he completes the nest without securing a mate, he starts another nest, and may tear to pieces the first nest and use this material in the next.

Another example was related to me by Mr. J. H. Storer of Waltham, Massachusetts. He had set up his photographic equipment about fifty feet from the nest of an Osprey (*Pandion haliaetus*). The bird flew away and shortly returned with a branch in its feet, dropping the branch on the nest without alighting. Twice again it flew off, broke off small branches with its feet, and returned to drop them on the nest.

The Osprey had previously brought many sticks to its nest. It was a normal act at certain times; here it appeared out of place, and the sticks were dropped on or near the nest because the presence of a person nearby kept it from coming closer.

Other examples which clearly illustrate the irrelevancy of this type of behavior are those in which the attack is transferred from the real object of disturbance to a substitute object. On Long Island, New

York, in 1935, I was climbing to the nest of a Blue Jay (*Cyanocitta cristata*). The two jays flew about screaming. They came within a few feet of me but did not attack me as they would probably have attacked a lesser enemy. As I neared the nest, one of the birds alighted a few feet above my head and hammered vigorously on the branch with its bill. This type of action is quite normal for jays under some other circumstances such as when opening an acorn held under their toes.

Somewhat similar incidents of irrelevant attacks are cited by Skinner (Bent, U. S. Nat. Mus., Bull. no. 170: 21, 35, 1939) for the Prairie Falcon (*Falco mexicanus*). When human intruders disturbed the birds at the nest, the falcons sometimes struck and even killed other birds in the vicinity of the nest. Dawson (in Bent, loc. cit.) explains it: "If she does not vent her spite on you, she will fall on the first wight who crosses her path."

These situations listed above all have this in common; the birds were confronted with circumstances with which they were unable to cope effectively, in an area they apparently did not want to leave. But in every case the bird did something. The act always was a normal act, one which the bird probably had performed many times before; but the circumstances under which these acts were performed were not the usual attendant circumstances of these acts. They were normal but irrelevant acts, substituted for relevant acts.

Many minor, less conspicuous acts appear closely related to this type of behavior. When a Song Sparrow (*Melospiza melodia*) brings food to the young in the nest and feeds them, it ordinarily pauses, which gives time for the young to defecate, whereupon the adult carries away the fecal sac. If the young does not void, the adult may stay for a few minutes and may peck at the head or body of the young or at the nest itself; it may even pick up stems from the nest and pass them through its bill; it may preen, or it may settle on the nest and brood, none of which acts, presumably, it would have performed if the young had provided a fecal sac to be carried away.

Tinbergen (op cit.: 227) suggests that the substitute (or irrelevant) acts tend to 'use' a pattern closely related to the normal actions. Looking at the above examples with this in mind, it appears that this is true of the jay and the falcon. The same might be considered true of the Vermilion Flycatcher. It used 'display and song,' which have significance in the protection of its territory from others of its own species, but not from predators. The actions of the Phainopepla and the woodpeckers were probably used in the original nest con-

struction, and would be used again if the present nest were destroyed, and the same might be said in part for the Osprey's actions, but these do not appear to be at all similar to any normal nest-defense actions, nor does the attempted copulation of the Vermilion Flycatcher.

The ulterior biological function of an irrelevant act is incidental and accidental. In the above incidents, one action—that of the woodpeckers—was once beneficial; one was detrimental—that of the Phainopepla; the others were neutral.

A convincing explanation of this type of behavior is not immediately evident. Huxley (loc. cit.) calls them self-exhausting acts, the performance of which provides satisfaction to the bird; Tinbergen (loc. cit.) says they are parts of one cycle of behavior substituted into another cycle of behavior and suggests a psychological explanation of conflict of drives. In any case it is a type of behavior of widespread, sporadic occurrence. Giving it a name does not explain it, but having a name for it helps in briefly referring to some of its characteristics and correlating it with similar phenomena.

Kirkman (Bird Behavior: 78–80, 213, 1937) has used the term 'substitute reaction'; Tinbergen (loc. cit.), the term 'substitute behavior.' In view of the different uses of the terms 'substitute' and 'substitution' by various authors, as substitution for conditioning (Watson, Behavior, An Introduction to Comparative Psychology: 272, 1911) and for the use of less desirable food when more desirable food is absent, and for the use of a less desirable sex partner when a more desirable one is lacking (Katz, Animals and Men: 157, 195, 1937), it seems advisable to use some other term for this type of behavior. Since irrelevancy is the main criterion for evaluating the behavior, 'irrelevant behavior' seems a more suitable term.

National Museum of Canada
Ottawa, Canada

NESTING HABITS OF THE YELLOW RAIL IN GASPÉ COUNTY, QUEBEC

BY L. MCI. TERRILL

Plates 5, 6

WHILE on a holiday in Gaspé in 1939, my wife and I had the pleasure on July 5th of hearing for the first time the unmistakable calls of a Yellow Rail (*Coturnicops noveboracensis*), in a marsh near the coast between Percé and Gaspé. The notes have a decidedly flinty

character which may be imitated rather accurately by striking two pebbles together and might be written: *'teck-teck - - teck teck teck.'* Once the song was reminiscent of hay-cutting—the rapid whetting of a scythe, an implement that is still used on the steep slopes of Gaspé's hills. Again it suggested the action of a hay-raking machine in the distance. These similes are the result of first impressions and were not suggested by Peabody's (1922) experience in the 'Big Coulee' of Benson County, North Dakota, where he generally found nests of this rail hidden beneath wisps of marsh hay left by the rake in the previous season. These sounds, however, lack the rather monotonous rhythm of the Yellow Rail's song. We heard it many times on this occasion and later, but did not record a single variation in time, pitch, tone or inflection.

Walking in the direction of the sound we soon had the satisfaction of flushing the bird and had a fair view of it before it dropped waveringly into the marsh a short distance away. Later, we flushed it again. We attributed our success partly to the undeveloped condition of the vegetation, a conjecture strengthened by experience with Sora and Virginia Rails which are often put up when the sedges are short, but seldom later in the nesting season. In brief, it would appear to be the lack of adequate cover that induces rails to fly when their haunts are invaded by man. Our search for the nest was unsuccessful as was the case on the 7th and 9th. On each occasion the bird called frequently but was not flushed again.

Next year (1940) we decided to learn, if possible, something more about the elusive bird. Reaching the marsh at dusk on the evening of July 19 we heard nothing whatever from the rail, although we remained in the vicinity for an hour. Toads were singing commonly but the only bird notes heard were the cackling of a Wilson's Snipe (*Capella delicata*) and from the neighboring spruce bog the songs of Olive-backed Thrushes (*Hylocichla ustulata swainsoni*). Next morning, however, the rail was calling vigorously in bright sunshine when we arrived about nine o'clock and continued to do so intermittently during our stay of four hours. In our limited experience the vocal activity of this rail is greater in the daytime than at night. We visited the marsh on three occasions after dark and heard it only once, whereas it was always heard during daylight visits. In any case it appears to be decidedly more diurnal in habit than either the Sora or Virginia Rail.

Although we failed to find the nest or even see the bird on this occasion, we did come to the conclusion that it called more frequently

in a certain portion of the marsh than elsewhere. Returning on the 24th, we began a determined search in this area and in less than ten minutes found the nest in a dense patch of the widely distributed bulrush (*Scirpus validus*), the prevailing sedge in this portion of the marsh where it occurs in almost pure stands.

The marsh was part of extensive lowlands at the base of a range of hills, the source of several streams which meandered successively through coniferous bog and open marsh in their tortuous course to the sea, eventually debouching into salt flats whose saline nature was indicated by the presence of such plants as sea milkwort (*Glaux maritima*), seaside crowfoot (*Ranunculus cymbalaria*), the tiny starwort (*Stellaria humifusa*) and its boon companion, the tinier sedge (*Humifusa subspathacea*).

The bulrush beds, apparently the centre of attraction for the rail, occurred in greatest abundance along the margins of shallow water lanes which in some cases were merely backwaters of the streams. Here and there were drier mounds where the bulrushes were partly displaced by shrubbery in which the following plants predominated:—sweet gale (*Myrica gale*), shrubby cinquefoil (*Potentilla fruticosa*), tall meadow-rue (*Thalictrum polygamum*) and American burnet (*Sanguisorba canadensis*). Owing to the presence of much free water, certain other sections were apparently just as unsuitable to the bulrush. Here the buckbean (*Menyanthes trifoliata*) was the prevailing plant with an occasional hoary willow (*Salix candida*). In addition to several sedges and grasses, plants found in the drier portions of the open marsh included Alpine bistort (*Polygonum viviparum*), swamp pedicularis (*Pedicularis palustris*), purple eyebright (*Euphrasia purpurea*), smaller purple-fringed orchis (*Habenaria psycodes*), tall leafy green orchis (*Habenaria hyperborea*), tall white bog orchis (*Habenaria dilatata*), hooded ladies' tresses (*Spiranthes romanzoffiana*) and white adder's-mouth (*Malaxis brachypoda*).

The nest was beneath a flattened swath of dead rushes, further concealed by the living plants which were from four to six feet in height and in fresh flower. It was built between stems of living rushes and partly supported by them, though actually resting lightly on the ground. There was very little other growth in these bulrush beds except about the margins, where a few diminutive sweet gale shrubs and a bedstraw (*Galium*) struggled for existence. Within the beds, clinging to the spongy, water-soaked ground, were a few mosses, straggling plants of bog cranberry (*Vaccinium oxycoccos*) and the flattened, moss-like leaves of a bladderwort (*Utricularia intermedia*)

which only flowered about the margins of free water in the treacherous sink-holes found between the rush beds. I mention this for the reason that the nest was composed of fine, dried grasses and sedges which must have been brought from other portions of the marsh. A very few pieces of the pithy bulrush stems were incorporated in the body of the nest but the lining was entirely of fine material. The preponderance of fine material and the compactness of the structure, which measured in outside diameter 5.4 x 4.9 inches and 3.4 inches in outside depth, suggested the nest of a large finch rather than that of a rail, except for the disproportionate depth.

There were nine eggs of a warm, creamy-buff, eight of them encircled about the large end with compact wreaths of rufous-brown spots, in some cases almost covering the apex. The ninth egg was more lightly wreathed near the smaller end. Otherwise they were practically immaculate.

Photographs were taken of the nest and habitat but we discovered later that the single attempt to snap the sitting bird, by releasing the shutter 150 feet from the nest, was unsuccessful, notwithstanding the fact that there were no 'watch-dog' Red-winged Blackbirds to give the alarm; nor did we at any time, no matter how cautious our approach, succeed in getting even a glimpse of her on the nest although the eggs were invariably warm. One of the birds, presumably the male, called frequently at distances varying from 100 to 300 feet from the nest, as nearly as we could judge, but we heard nothing from its mate until the young were hatched. No further attempt was made to photograph the bird for fear of accident as we wished above all to see the young. One of the eggs was taken to determine the state of incubation which was found to be advanced.

On the 26th there was no apparent change in the condition of the eggs at 11 a. m. Returning at 12:30, we found the crown of one of the eggs lying in the bottom of the nest and the chick making efforts to free itself from the remainder of the shell. On our next visit, at 4:30, one nestling was in the act of disappearing over the side of the nest, a second had already done so, and a third, wings outspread though barely dry, was laboriously progressing towards the edge. The eggshells were still in the nest with the five unhatched eggs. Not a sound was heard from parent or young, but profiting by experience with Sora and Virginia Rails we searched carefully beneath the nest and found the precocious youngsters crouching there.

The chicks were covered with luxuriant coats of long, glossy black down, similar to the down of nestling Sora and Virginia Rails. Apart

(Above) PORTION OF MARSH WHERE YELLOW RAILS NESTED, GASPÉ, QUEBEC.
(Below) NEST OF YELLOW RAIL.

from their smaller size, they differed principally from Sora nestlings in not having the orange goatee or the blood-red, blister-like protuberance at the base of the upper mandible; also in the total absence of a bare patch on the fore part of the head. This suggestion of baldness is very pronounced in Sora nestlings but scarcely noticeable in the young of the Virginia Rail. The feet were grayish-drab and the bill pinkish-flesh color with a tiny ivory egg-tooth near the tip.

Photographing the young in the nest required much patience as they were extremely fidgety and persistently attempted to escape. Efforts to leave the nest were redoubled when the first note of protest was heard from the female—a note that resembled closely the whimper, or murmur, of the Sora. It was more subdued, however, and barely audible, although the bird was moving about in the rushes in the immediate vicinity of the nest. It appeared to be emitted through the nostrils with mandibles closed, in the manner of a whimpering dog, and was evidently for the purpose of inducing the young to follow her. I have near heard a Virginia Rail give this note but both male and female Soras commonly do so when disturbed with young. I have also on two occasions (May 18 and 20, 1932) watched a whimpering Sora, presumably the male, following another Sora persistently. This took place in the late afternoon in a shallow wood-girt pond before nesting had started. The scanty growth at the time enabled me to keep the birds in view without difficulty as they circled the pond, a few feet apart, for several minutes. So absorbed as to appear unaware of, or indifferent to, my presence, they exhibited none of the nervous manner usually observable in rails, alternately wading in and out amongst the isolated grass clumps and without apparent hesitation swimming boldly across deeper portions of the pond. The male whimpered almost continually though, on a few occasions, it paused to give the common spring call, *ker-wee*. I am convinced that this was a courtship performance.

To return to the Yellow Rail, we were satisfied that the whimpering bird was the female because its mate sang occasionally during the performance which was repeated several times. We assumed that only one pair of Yellow Rails was present as we never heard more than a single bird calling at one time.

Experience with many pairs of Sora Rails in the Montreal District provides ample evidence that incubation in that species begins with the laying of the first, or at latest the second, egg, and that the eggs hatch at an average rate of one per day. The Sora is nearly always flushed from its nest as soon as egg-laying starts. The Virginia Rail,

on the other hand, is rarely found on the nest before there are six or seven eggs, and it would appear that incubation starts, as a rule, when the seventh egg is laid. In any case the young are all hatched within two, or at most three, days after the first chick emerges.

I had expected that the Yellow Rail would perform the duties of incubation somewhat in the manner of the Sora and was surprised to find at 9 o'clock on the following morning (July 27) that the remaining eggs had hatched and that all but one of the chicks had left the nest before we reached it. Thus within twenty hours from the appearance of the first chick all of the eggs had hatched and apparently incubation was only commenced after the last egg was laid. We found the egg shells 8 to 10 feet from the nest, the heavily spotted crowns neatly separated from the immaculate portions. Not one was cracked nor even dented and with care they might have been restored almost to their original condition.

Three of the chicks were found hiding beneath the nest and later the querulous *xzwee* of two others drew our attention to them as they moved in the direction of their mother who was more demonstrative on this occasion, whimpering frequently. Thrice she revealed her crouching form as she circled about us. Once she varied the whimper with a muffled *tuck, tuck, tuck,* and several times when near our camera case, in which three of the young were confined, a rapidly uttered *tuk, tuk, took took took,* in the tempo of a domestic hen calling her chickens, reflected her mounting excitement. We left the marsh at 10:30 in order to permit the distracted mother to collect her offspring. I have seen Sora and Virginia Rail nestlings return after being disturbed and clamber into the nest and hoped these Yellow Rail chicks might do likewise. On our return to the marsh at noon, however, when the male was calling a few hundred feet away, we were surprised to hear the familiar whimper about 100 yards from the nest in the dense growth of sweet gale and other shrubbery covering one of the drier mounds previously mentioned. Although we did not see the chicks on this occasion, two of them were heard complaining in the vicinity on the 31st, and the mother's obvious concern in both instances substantiated the assumption that they were being brooded somewhere in the undergrowth about this mound. We visited the nest on the afternoon of the 27th and on succeeding days but found no evidence that the chicks had returned.

A careful search here and elsewhere revealed none of the so-called dummy nests such as are habitually built by Sora and Virginia Rails and at least on occasion used by them for brooding young. This

applies especially to the Sora which frequently lays twelve or thirteen eggs and sometimes as many as fifteen. A supplementary nest must be very useful in such cases—decidedly so when the natal nest is too small to accommodate the eggs in a single layer and in view of the fact that they hatch at the rate of one a day. It would be extremely difficult or impossible for the parent to incubate successfully while brooding an ever-increasing family. In any event, it has been my experience that the male Sora frequently, if not regularly, broods some of the young in a dummy nest while his mate incubates the remaining eggs. The term 'cock nest,' sometimes used to designate these extra nests, would appear to be particularly applicable to the Sora.

It is a comparatively simple matter to find dummy nests of the Sora and Virginia Rail and, in the smaller marshes, it is often possible to determine whether they have been used. Ascertaining the habits of the Yellow Rail in this respect is quite another matter. In this instance it would have been impracticable, if not impossible, and although the bird may not have required or used an extra nest for brooding it may, of course, have built additional nests as do many other birds which have no recognized use for them. Nests for sleeping places are not as a rule needed by perching birds and, with a few exceptions, are not constructed by them. Wrens are probably the most noteworthy exceptions. Skutch (1940) has furnished abundant evidence that most Central American wrens construct extra nests in which they sleep, either singly, in pairs or in family groups. In Quebec Province, Marsh Wrens, both Long-billed and Short-billed, usually build four or more dummy nests and occasionally as many as ten. Although some of these are poorly made, each pair as a rule lines at least one of the surplus nests with a warm bed of down from the cat-tail heads and it is probable that these indefatigable architects, as in the case of their Central American cousins, employ some of the product of their industry for bed-chambers. Dry sleeping places are not often available ready-made to non-perching, terrestrial birds in a wet habitat and the preparation of these would undoubtedly be of great advantage, especially to birds of a timid, secretive nature. This would obviate any need for seeking a comfortable resting-place in drier situations on the outskirts of the marsh where they would be in greater danger from prowling carnivorous mammals and it may well be the basic reason for the dummy-nest-building habit so prevalent amongst rails and gallinules.

The Yellow Rail is evidently a lover of solitude. Other birds were

rather scarce in this marsh. The songs of two loud-voiced warblers—the Northern Water-Thrush (*Seiurus noveboracensis*) and Tennessee Warbler (*Vermivora peregrina*), reached us occasionally from the border of the spruce bog, but a few Swamp Sparrows (*Melospiza georgiana*) were the only birds heard singing in the open marsh. A nest of the American Bittern (*Botaurus lentiginosus*) was found on July 20 with two young and an egg about to hatch. On July 5 of the previous year we found a nest of this species in the vicinity with four young a day or two old. These dates give some idea of the late nesting of birds on the Gaspé coast.

The other inhabitants included several families of the Black Duck (*Anas rubripes tristis*), an agitated male Blue-winged Teal (*Querquedula discors*) and a brood of Pintails (*Dafila acuta tzitzihoa*) with their mother. The presence of Pintails is notable as I know of no other nesting records for the Gaspé coast. In addition to the solitary Wilson's Snipe already mentioned, we also saw several Black-crowned Night Herons (*Nycticorax nycticorax hoactli*) and on one occasion (July 31) two Greater Yellow-legs (*Totanus melanoleucus*) which probably nested farther inland.

Our knowledge of the breeding range of the Yellow Rail is probably very incomplete, but a study of published records brings out certain facts which I think are worthy of note. In addition to the present record for Gaspé, nests have been recorded only from the following localities:—California (Mono County), one; North Dakota (Benson County), several; Michigan (northern and southern peninsulas), one each; and Ontario (Toronto region), one. It no doubt also nests in several other districts where it has been heard singing and where specimens have been taken in the summer months, notably in central Canada, in the extensive marshes bordering James Bay and Hudson Bay between Moose Factory and Churchill, and in the Lake Winnipeg region. In all of these localities it occurs in marshes of considerable extent. Sora and Virginia Rails nest almost at our back doors in marshes of less than half an acre but the Yellow Rail apparently prefers the more secluded conditions prevailing in extensive marsh lands where, moreover, it is often decidedly gregarious. Gregariousness and a tendency to frequent the same particular stopping places from year to year also appear to be habitual amongst migrants. This is emphasized by Morris (1905) who, with the aid of his dog, found Yellow Rails in some numbers frequenting a certain wet meadow in the Connecticut Valley near Springfield during September and October. He found others in the same meadow in several suc-

YELLOW RAILS A FEW DAYS OLD.

cessive seasons, but none elsewhere in the district though he was in the habit of hunting in many similar meadows. Walkinshaw (1939) records an instance of apparent desertion of the nesting place by a colony of Yellow Rails. In June, 1934, he found this species common in the "large Convis Township marsh" in Chippewa County, Michigan, but found none there in June, 1935. In my experience the Short-billed Marsh Wren (*Cistothorus stellaris*), which has been reported as a frequent associate of the Yellow Rail, is very exacting as to the moisture content of its nesting habitat. In seasons when a nesting haunt is excessively wet, or when drainage, fire, drought or other cause appreciably reduces the moisture content, it is generally unoccupied by the wrens, but they will often reappear in the succeeding years when the former conditions have been restored. It is probable that Yellow Rails are similarly affected by moisture conditions. Presumably they would prefer a habitat with a moisture content that would ensure the best proportion of three essentials:—(1) food; (2) cover for shelter and to provide immunity from attack by predatory birds; and (3) sufficient free water to provide a degree of security from roaming mammals. Some such change in the Convis marsh might offer an explanation for the absence of the rails. On the other hand the repeated use of dogs for the purpose of flushing them might, conceivably, have caused these exceptionally timid birds to seek a haven elsewhere.

Meredith (1935) has collected evidence of the occurrence of the Yellow Rail in the Province of Quebec and gives a number of records of birds secured by hunters during the months of September and October. The only summer records mentioned are three birds taken in Kamouraska County—one at Kamouraska on August 1, 1922, and two at Ste. Anne de la Pocatière on June 23 and 24, 1930. As far as I can learn there are no further records for either locality. The present known status of the Yellow Rail in Quebec Province is therefore as follows:—

Fall	—More or less regular migrant in small numbers, principally along the St. Lawrence River near Quebec City.
Spring	—No record.
Summer	—5 birds—observed in 3 localities (Kamouraska and Gaspé counties).

Nesting Record—One (Gaspé).

It is the general opinion of observers of this rail in migration that it is one of the most elusive and secretive of birds and rarely flushed

without the use of a dog, and it is, of course, quite possible that it may be a far more common migrant than the records indicate. Those who have heard it in the nesting season, however, agree that its song is very distinctive and could scarcely be mistaken for that of any other bird; also that it sings with unusual abandon. It was the peculiar song of the Yellow Rail that led to the discovery of the summer birds recorded above and it is significant that in three instances their presence was reported to local naturalists by casual observers who were intrigued by the strangeness and persistence of the calls. In view of this and the fact that the song can be clearly heard from a distance of more than 200 yards (Peabody records hearing it a quarter of a mile away under favorable conditions), one can only conclude that the Yellow Rail is either exceptionally selective in choosing a nesting place and confined to a few isolated districts in Quebec or almost entirely absent in the breeding season in the central and southern portions of the Province.

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Westmount
Quebec

BREEDING HABITS OF McCOWN'S LONGSPUR

BY FRANCES WELTON MICKEY

INTRODUCTION

THE McCown's Longspur, *Rhynchophanes mccowni,* is a bird typical of the western plains. Early explorers of the great Northwest reported it nesting on the vast, rolling prairie benches of the Rocky Mountains. These longspurs now confine their nesting to the uncultivated stretches of this region from northeastern Colorado to southern Canada.

During the spring and summer months of 1938, 1939 and 1940, I studied the longspur population of a forty-acre field east of Laramie, Wyoming. This field had never been cultivated, and it had not been grazed since being fenced about ten years before. The rocky soil supported a growth of prairie grasses and low shrubs. The water supply was restricted to dew and to puddles left after showers.

This study was conducted mainly by observation during repeated censuses of the field. The observations contained in this paper include notes on spring migration, the relationship of song to the establishment of territory, courtship, parental activities relating to nest building, laying of the eggs, incubation, guarding of the nest, and care of the young, and growth records for forty young birds. Each year a large-scale map was prepared, upon which the approximate territories of each male were plotted and the nest sites marked. During 1938, the eggs of each set found were measured and then marked with indelible pencil, in order to secure consecutive weights throughout the incubation period, and information concerning hatching. In order to keep separate records of the growth and development of the forty nestlings, the down on the top of each head was daubed with colored, waterproof ink. Five colors—red, black, yellow, blue and white—were used and repeated in the various nests. By the time the down had worn off the head, the young bird was large enough to be banded.

MIGRATION NOTES

McCown's Longspurs winter in the southwestern United States and northern Mexico. Their breeding range covers most of the "Transition Zone from central Alberta and southern Saskatchewan to southeastern Wyoming, northeastern Colorado, northern North Dakota, and southwestern Minnesota" (1). McCreary (9) reported that, while this longspur is "the most numerous nesting bird" in southeastern Wyoming, its distribution throughout the state is "quite spotted."

The vanguard of migrating males usually arrived on the Laramie plains during the first week of April. Early arrival dates for southeastern Wyoming have varied from the exceptionally early record of March 12 (observed by Frank Bond at Cheyenne in 1889) to as late as April 24 (observed by O. C. McCreary in the Sand Creek region of Albany County in 1927). Ordinarily one might expect to see the first male between the 6th and 8th of April (9). By the third week in April large flocks of male longspurs were common. These flocks spent most of the time feeding. However, those among them who were selecting territories sang a great deal, not only in characteristic flight-song, but also from perches on the tops of rocks or shrubs within their chosen areas. At this time scattered groups of females made their appearance. By the last of April the females became numerous. Later than this, females were seldom seen in groups, for the transients had moved on, and the resident females had separated and spread out over the areas being defended by singing males. After a female settled in a territory, the pair of birds usually kept together.

DuBois (7), in Montana, observed early arrivals from April 13 to 18, with an increase in numbers between the 18th and 20th, after which they decreased in numbers. They became common by the first of May and abundant by the 4th. He made no mention of the ratio of the sexes present at any given time, but it seems likely that the second increase was due to the arrival of the females.

Tinbergen (15) reported that female Snow Buntings in Greenland behaved much the same. They arrived on the breeding grounds about a month later than the males, and remained in flocks only a short time. Then, one by one, the females left the flock and entered some male's territory.

TERRITORY

McCown's Longspurs, being gregariously inclined, tended to retain something of a colonial formation even during the breeding season. Within the loosely-formed flocks each pair was in possession of its own territory; but, as soon as the young were on the wing in the fall, territories were abandoned.

The male proclaimed his right to a territory chiefly by a characteristic flight-song. In the early spring he was a persistent and exuberant singer. He mounted into the air, spread his wings and floated downward, repeating over and over the phrases of his song, *see, see, see me, see me, hear me, hear me, see.* Sometimes the bird did not alight after one descent, but rose immediately for another song.

A fairly good estimate of the size of a particular territory could be

determined by marking the places where the songster alighted. Occasionally he was seen flying low along what seemed to be the territorial boundaries, singing as he flew.

The first males to settle in a region claimed territories that were larger than necessary. As more and more resident males arrived, they tried to establish themselves on ground already claimed by others. The newcomers that I observed succeeded in holding the territories that they appropriated. However, these were instances in which the original territories had been sizable and the adjusted territories were seldom less than 250 feet in diameter. As their territories decreased in size the birds increased the vigor of their defense, in order to keep an area of sufficient size around the nest from which the adults could secure the large quantities of food needed by the young nestlings and still be able to brood them for long periods. The fact that both male and female longspurs fed and brooded the nestlings, as will be discussed later, indicated that prolonged brooding during the first few days was as essential to the survival of the nestlings as sufficient food.

For the male longspurs, who held small territories in areas where more birds congregated, the conspicuous flight-song and occasional chasing of an intruder were not sufficient to hold their territories; they often had to fight neighboring males. The bird defending a territory challenged the trespasser by flying at him, singing and rapidly fluttering his wings. If the intruding bird was easily intimidated, he was chased off the territory; if not, the two males rose in the air fighting.

The two notations that follow are descriptions of typical territorial defense, or 'sexual fighting' as it is termed by Tinbergen:

(a) On April 27, 1940, M26 descended from a flight-song and alighted in the territory claimed by M25. Immediately M25 crouched and ran rapidly through the grass to peck the trespasser. Both birds rose in the air, bill to bill, singing and fluttering their wings. After they came down M26 retreated into his own territory. He was not followed by M25.

(b) An interesting situation arose early in June, 1938, when a new bird, M10, attempted to encroach upon the territory of an established bird, M2, at the same time and close to the same place that a nest was being constructed by M2's mate. M10 was an aggressive bird and finally succeeded in establishing himself in a small area, about 250 feet in diameter, in spite of many fights. When he secured a mate, it so happened that she chose a site for her nest close to the disputed boundary. On July 7, I watched these two pairs of birds for an hour or more. M10 was engaged in flight-song within his own territory when I arrived. After each descent, he hovered over the nest site, and then flew directly over into M2's territory, uttering a sharp *tweet-twur* on the way. M2 immediately flew toward M10, singing. They met head on and rose high in the air; then, bill to bill, singing lustily and with wings beating vigorously, they dropped to the ground, and each

retired to his own territory. This performance was repeated eight times within twenty minutes. Once M10 was joined by his mate; the two of them flew into M2's territory, but both were driven back. During these fights, another male, M1, whose territory also adjoined that of M10, kept singing over his own territory. When not in flight-song, he sang from a rock near the boundary. This group of birds continued to behave this way for several days. Every so often during the next two weeks, both M10 and M2 were seen flying low along the boundaries of their respective territories. Neither male rose to challenge the other at such a time.

Territorial defense by male longspurs was directed against intruding male longspurs, who by their song and actions indicated that they were trying to establish themselves on a territory. It was not directed against non-competing males, nor those busy feeding immature birds, nor against males of other species frequenting the area.

Similar behavior in regard to territorial activities was noted by Tinbergen in Snow Buntings and by Pickwell in Horned Larks (13).

Tinbergen (15) stated that singing on the Snow Bunting territories developed gradually. At first the males sang on their territories in the early morning, but during the remainder of the day, they foraged on neutral feeding areas. Song and time spent within the territory increased, until by the middle of May "foraging was done more exclusively within the territory."

After longspurs settled on their territories, they sang from or over these areas at intervals throughout the day and well into the evening. They seldom left their territories, but when they did, their departures were of two types:

(a) Several birds would fly up, usually in response to a particularly sharp chirp uttered by some one individual, and would circle over the field in flock formation, chippering continually. After a few minutes the little group would settle quietly in the grass and disperse, feeding as they went. Such short flights were most common in early spring and in late July and August.

(b) At times longer, solitary flights were made. These were as common with the female as with the male, and might occur at any time during the breeding season. With field glasses, I have watched a bird fly away until it was completely lost from view. I am not certain as to the purpose of these flights. I doubt that food or water played any part in instigating them, for individual territories contained as much food as any other portion of the prairie. There were few late-spring snows heavy enough to cause a concentration of food, such as Tinbergen reported as occurring in Greenland with Snow Buntings. Although there were two ponds a short distance from the field, I have never seen longspurs visiting them during the nesting season.

A comparison of the territorial activities of McCown's Longspurs with those of Horned Larks, Song Sparrows and Snow Buntings (as described respectively by Pickwell, Nice and Tinbergen) showed similar behavior on the part of the males of all four species. The males, which arrived early, claimed large territories. As new resident males continued to arrive and establish themselves, these large territories decreased in size until a certain minimum was reached, below which the territory would not have answered the needs of the birds. Defense efforts increased inversely with the size of the territory, until, when the minimum size had been reached, a newcomer was no longer able to establish himself. Territories were proclaimed by song and defended by song in combination with threatening actions and aërial fighting.

COURTSHIP

The presence of the female within the territory stimulated the male to behave in a definite way. Observations on M25, which had been an extremely vigorous singer prior to mating, indicated that after mating, he spent less time in flight-song and more time in the company of the female. He was frequently seen singing softly from the top of a small rabbitbrush, meanwhile making little bows to the female in the grass below. Occasionally he would hold up one wing while he sang. At another time, while on the ground, he raised the wing nearest the female and held its silver lining before her. Then he ran over to the female; they both flew up and settled in the grass some ten feet away. This behavior might be comparable to reactions of the female Snow Bunting to the first attempts at copulation by the male, which usually result in flight because the two birds are not in the same physiological state.

DuBois (7) related how a male, which had been singing with one wing aloft, ran past his mate, singing and "hoisting his white sail on the side toward her" after she had responded by raising quivering wings. This female was probably in a physiological state more nearly identical with that of the male.

Some few cases of bigamy have been reported in Snow Buntings and in Song Sparrows. The closest observation of such a nature that I have on longspurs was the following odd case of two males and one female in the same territory:

On May 20, 1940, I came upon a pair of longspurs feeding side by side at the edge of the field. The female flushed and was followed by the male; as they settled in the grass, another male alighted beside them. Both males rose fighting; finally one was driven off. The victorious male returned to the female, which

had remained on the ground, and started bowing to her. The other male returned; again they fought and chased each other about until the female flew a short distance into the field. One male followed and dropped close beside her; the other perched on the nearby fence. On May 24, the nest in this territory was practically finished, but the two males were still fighting each other. Two weeks later, this nest was destroyed and one of the males disappeared. I am not sure that there was any connection between these two events.

Tinbergen (15) stated that one of the conspicuous features of the behavior of a newly-mated Snow Bunting was the abrupt cessation of his song. The male sang again whenever his mate disappeared, regardless of whether the female had merely moved out of sight or was incubating within the nesting hole. In contrast, the male longspur did not stop singing after mating. There was a short interval—from the time of mating until the female started her nest—in which the male performed few if any flight-songs, but he often sang from a perch on top of a rock or shrub within his territory. As soon as the nest was under way flight-song was resumed and continued until the eggs hatched. The following instance will serve to illustrate:

I approached M2 after he had descended from a flight-song and was perched on the top of a small rabbitbrush (he had not been seen in flight-song during the preceding two days). The female was flushed from beside this bush where she had been scratching out a nesting hollow. M2 continued his flight-songs, not only during the following three days when his mate was working at the nest, but also after she started laying.

With the beginning of each new nesting cycle, the male engaged in flight-song. Prior to the last brood of the season, song was much abbreviated; the males neither rose as often nor did they sing during the entire descent.

A new nest was constructed for each brood, usually at some distance from the old one, either within the previous boundaries of the territory or close enough to it so that, in uncrowded portions of the field, adjustments in the boundaries could easily be made. The male usually changed his song center so as to be closer to the new nest. In some cases this resulted in fighting the male of an adjoining territory. If the female built outside of the original territory, the male incorporated the new nest site into his territory even though it involved fighting the former owner. Similar actions have been reported by Nice for Song Sparrows (12), by Dewar for European Blackbirds (4), and by Tinbergen for Snow Buntings (15).

NESTS

The nests were built by the females in shallow depressions in the ground. In several instances there was evidence that at least some

excavating had been done by the birds, although they may have taken advantage of the numerous hollows already existing, when these met their requirements for nest sites.

The depression was lined with a variety of materials ranging from dried grasses to shredded plant stems. To this an inner lining of softer, finer material was added. The majority of the nests were constructed entirely of grasses, the body consisting of coarse stems and blades, and the inner lining of finer grasses. There were some exceptions to this, however; the body of nest 2 contained bits of lichen along with the coarse grass; that of nest 23 was constructed from the coarse, shredded bark of horsebrush and rabbitbrush; nest 10 had three down feathers worked into its inner lining; bits of wool were found in the lining of nest 11; while nest 8 was lined entirely with wool.

DuBois (6) reported that of the thirty-four nests observed by him, the bodies or the 'primary linings' of thirty-one of them consisted of dried grasses, the other three contained weed stems or roots. In regard to the inner linings, he stated that ten nests were lined with the same type of material as used in the body, twelve contained horse or cow hair, three contained finer grasses, one contained hair and bird feathers, one included fresh grass and plant fiber, and another the outer husks of wheat stubble. A nest taken by J. A. Allen, July 7, 1873, on Heart River, Dakota, was "constructed of decomposing woody fibre and grasses, with a lining of finer grasses" (3). Bailey (2) stated that the nests were built largely of grass and generally lined with hair and feathers.

The female gathered the nesting material within the territory. No wanderings in search of material, such as those observed by Tinbergen (15) in the case of the Snow Bunting, were noted in this species, since within the territory itself there was a great abundance of the grasses and fibers used. Very likely the nests constructed entirely of grass represented the primitive type of material used for nests before sheep, horses and cattle were introduced into this region. However, when such materials as wool and hair became available, the birds made use of them. Wool for the linings of nests 8 and 11, mentioned above, was collected from bits of wool which clung to the barbed-wire fence bordering the territories in which these nests were located.

In all the nests which I observed, the rim of the nest was flush with the ground. DuBois (6) observed two exceptions: in one case the rim of the nest was below the surface of the ground; in the other it was above. In the latter case, the foundation of the nest had been woven into the grass surrounding the excavation.

Dimensions of six longspur nests were taken. Of these the outside diameters varied from 3.125 to 3.5 inches, the average being 3.4. The inside diameters varied from 2.25 to 2.625 inches, the average being 2.46. The depth of these six nests ranged from 1.75 inches for the shallowest to 2.25 for the deepest, with an average of 2.08. DuBois (6) reported the average of four internal diameters to be 2.34 inches and the average depth to be 1.94. On the whole the nests tended to be wider than deep. I found only one case in which a nest was deeper than wide. This was nest 11, which had an inner diameter of 1.25 inches and a depth of 2.5. DuBois (6) mentioned one instance in which the inner diameter and depth were identical.

Three nests which had been used by the birds were collected and weighed; they averaged 9.0 grams. The average of eight ground nests of Song Sparrows was 16.15 grams, that of eight Prairie Horned Lark nests in Illinois was 15.28 grams, and that of five Prairie Horned Lark nests in New York was 9.88 grams (11).

The manner of concealment varied from those nests placed beside a few spears of grass to those well concealed beneath overhanging branches of rabbitbrush. Out of a group of forty nests, nineteen were beside grass clumps, fifteen beside rabbitbrush, five beside horsebrush, and one between rabbitbrush and horsebrush.

There are several dissimilarities between the nests of McCown's Longspurs and Snow Buntings. Although the nests of both species were placed in hollows, the longspur nests were built in the open and constructed mainly of dried grasses, whereas the Snow Bunting nests were placed in hollows in the bottom of rock crevices and were constructed of moss and earth with a layer of *Carex* leaves and a lining of feathers. The female Snow Bunting commonly made several nesting attempts before the final nest was completed (15). Only three unfinished longspur nests were found.

LAYING OF THE EGGS

Presumably the female longspur laid early in the morning. I have the following two notations in regard to laying:

(a) On July 8, 1939, at 7 a. m. I observed F18 flying about in small circles just above the top of the grass in the vicinity of her nest. When I came into the territory, she flew away. Then her mate flew around me as if he were trying to drive me off; so I walked a short distance away and sat down. About five minutes later the pair returned to the nest site; the female dropped into the grass, the male perched on the top of a nearby rabbitbrush. After a while he hopped down and fed. I walked over and flushed the female from her nest, which contained one warm egg.

(b) Nest 27 was visited at 6:30 a. m. on May 21, 1939. At this time it con-

tained two eggs. At 7 p. m. it still contained two eggs, but at 6 a. m. on the following day there were three eggs in the nest.

From these two instances, I presumed that McCown's Longspurs deposited their eggs early in the morning, although possibly not as early as the Snow Buntings. Tinbergen (15) stated that Snow Bunting eggs were laid between 3 and 4 a. m. The females of both species exhibited some restlessness prior to laying an egg.

NUMBER OF EGGS

The complement varied from three or four to an occasional five. Out of the thirty-eight nests in which I took an egg count, eighteen contained sets of three eggs each, eighteen contained sets of four eggs, and two contained sets of five eggs.

DuBois (6) reported twenty-four sets of three eggs each, twenty-six sets of four eggs, and two sets of five eggs from birds nesting in Montana. Nice (11) in Oklahoma, reported one set of five eggs and one set of six eggs. John Macoun (8) found two sets of four eggs each at Crane Lake, western Canada, in 1894 and 1895. Of the eleven nests located by Brown (14) in Minnesota from 1891 to 1899, six contained three eggs each and five held four eggs each.

Neilson (10) reported full sets of eggs at Wheatland, Wyoming, by May 20. McCreary (9) located a full set of eggs at Laramie, Wyoming, on June 2, 1927. On June 3, 1936, he found young longspurs that were able to fly, which would indicate that the eggs may have been laid as early as May 9. DuBois (6), in Montana, found sets complete by May 9, and young out of the nest, but unable to fly on May 23, 1915, from which fact he presumed eggs deposited as early as the first of May. Brown (14), in Minnesota, reported five nests with nearly fresh eggs on May 17.

In the field under my observation, the earliest nest was number 27, found on May 20, 1939. At that time it contained one egg; the full complement of four eggs was complete on May 25. The last egg in nest 23 hatched on August 8, 1938. The latest date for a full clutch was August 6. DuBois (6) reported July 28 as the latest date for eggs in Montana.

COLOR OF EGGS

The ground color of McCown's Longspur eggs varied from white to pale olive. The markings consisted of various combinations of lines, scrawls, spots, and speckles of lilac, rusty-brown, mahogany, and in one case black. The sets showed some variation, but ordinarily the eggs within a set were quite uniform in color and arrangement of markings. Some eggs were marked over the entire surface, while

on others the markings were confined to the larger end. The scrawls might be either bold and heavy or very faint, in which case a fine speckling usually covered the shell.

The following descriptions will give some idea as to the variation in color. The eggs in nest 6 were a dirty white, heavily streaked with mahogany and rusty-brown scrawls. In direct contrast was the clutch in nest 19, which was so finely stippled with lilac and rust that the eggs appeared to be a plain lilac color. The eggs in nest 8 were white with fine spots of rust, lilac and mahogany at one end and heavy scrawls of dark brown at the other. The set in nest 10 was finely speckled with a few heavy scrawls encircling the middle of each egg. In nest 16 the eggs appeared lighter than usual due to the fine, sparse dotting on a pale, buffy ground. The one egg in nest 18 had a purplish band of fine spots encircling the wider end. The eggs in nest 42 were pale gray, sparsely speckled with lilac.

Bailey (2) described the eggs as "green or white, spotted with blackish or shades of brown; or white unmarked." I did not find any unmarked eggs.

Brown (14) stated that there was a remarkable variation in the color pattern of sets, but that the eggs within a set were alike in ground color and markings. The pale greenish ground color varied in intensity, occasionally being obscured by a buffy tinge. Some sets were marked over the entire surface; others were sparsely marked with dots, splashes and scroll markings of various shades of brown, from light reddish to almost black. On some eggs there were purplish areas due to buried pigment.

SHAPE OF EGGS

Most of the eggs were oval in shape. A few exceptions were found: in nest 6 there were three elliptical eggs and one pyriform one, and in nest 8 there were three elliptical eggs.

SIZE OF EGGS

Seventy-two eggs were measured. They ranged in length from 1.9 to 2.25 cm., and in width from 1.45 to 1.65 cm. The longest egg, which also happened to be the largest, measured *2.25* by 1.60 cm. The shortest egg measured *1.90* by 1.60 cm., the widest egg 2.05 by *1.65 cm.*, and the narrowest egg 2.05 by *1.45 cm.*

The average size of these seventy-two eggs was 2.055 by 1.546 cm., or 0.8089 by 0.6086 inches. Brown (14) reported that the average size of thirty-four eggs which he measured was 0.81 by 0.57 inches.

WEIGHT OF EGGS

Fresh eggs varied in weight from 2.3 to 2.5 grams; the average of six was 2.4. Eggs weighed the day before hatching varied from 1.7 to 2.15 grams; the average of seven was 1.914 grams. The daily loss in weight of approximately 0.05 of a gram would, during the period of incubation, amount to a loss of about twenty per cent in the weight of an egg.

The average total weight of a three-egg set was 7.21 grams as compared to 9.5 for a four-egg set and to 11.4 for the one five-egg set weighed. A comparison of the weights of these sets showed that the actual weight and size of the individual egg in a three-egg set was slightly more than that of the individual egg in either the four-egg or the five-egg set, as shown in the following table:

TABLE 1

THE DIFFERENCES IN WEIGHT AND SIZE OF AN EGG IN SETS OF DIFFERENT SIZES

Number of eggs in set	*Number of sets weighed*	*Average weight of egg in grams*	*Number of sets measured*	*Average size of egg in centimeters*
3	4	2.40	4	2.05 x 1.58
4	5	2.37	12	2.06 x 1.54
5	1	2.28	1	2.06 x 1.51

The eggs within a set were usually quite uniform in all respects, but occasionally there were some variations. The exceptions in size, shape and weight do not follow the chronological order of laying as may be seen from the following:

In nest 7, two eggs of exactly the same size and shape were laid on successive days; on the third day, a slightly narrower, lighter egg was deposited. This clutch was not completed on the fourth day, as would normally be expected, but on the fifth day. The last egg was of the same size and shape as the third.

In nest 21, the first two eggs laid were identical in size and shape, the third egg was slightly shorter and lighter, while the fourth was definitely lighter and somewhat shorter and wider.

1—2.50 grams; 2.20 by 1.55 cm.
2—2.50 grams; 2.20 by 1.55 cm.
3—2.45 grams; 2.10 by 1.55 cm.
4—2.30 grams; 2.00 by 1.60 cm.

At nest 8, one large egg was deposited on the first day, followed on the second and third days by lighter, smaller eggs.

1—2.50 grams; 2.05 by 1.65 cm.
2—2.45 grams; 1.90 by 1.60 cm.
3—2.40 grams; 1.90 by 1.60 cm.

In nest 6, thought to be an earlier attempt by the same female as at nest 8, there were one large egg and three smaller ones.

In all of the above cases the larger, heavier eggs were the first to be deposited, but in nest 3 the procedure was reversed. This nest contained three eggs weighing 2.65, 2.40, and 2.30 grams when found. On the next day the nest contained a fourth egg, which weighed 2.70 grams.

The eggs in nests 11, 12, and 16 were all of a different size and weight. The weights and dimensions of the eggs in nest 12 were:

1—2.25 grams; 1.90 by 1.60 cm.
2—2.35 grams; 2.05 by 1.55 cm.
3—2.40 grams; 2.00 by 1.60 cm.

The eggs in nest 14 were very uniform in size, shape, weight and color.

1—2.47 grams; 2.05 by 1.55 cm.
2—2.50 grams; 2.05 by 1.55 cm.
3—2.50 grams; 2.05 by 1.55 cm.
4—2.48 grams; 2.05 by 1.55 cm.

Nest 20 contained the largest of all the eggs found.

1—2.70 grams; 2.20 by 1.60 cm.
2—2.70 grams; 2.25 by 1.60 cm.
3—2.70 grams; 2.25 by 1.60 cm.
4—2.25 grams; 2.20 by 1.60 cm.

Tinbergen (15) reported that the Snow Bunting clutch ordinarily contained five or six eggs, and that the one second clutch which he observed contained only three eggs. Late sets of longspur eggs were just as likely to contain four eggs as those laid earlier in the season. Of the two five-egg sets which I observed, one was laid in early June, the other in July.

INCUBATION

Incubation is thought to be performed entirely by the female. I did not at any time flush a male from a nest containing eggs. DuBois (7) stated that he had "never seen a male on the nests before hatching." The female was a close sitter and usually did not flush until practically stepped upon. If the bird did not catch your eye, she did not disclose her nest even though you passed close beside it.

On my second visit to nest 2, I was having difficulty spotting the nest in spite of a stone marker. I was standing less than a foot from

the incubating bird when I saw her. Not until I looked directly at her did she fly. This time she did not rise up with the customary flutter; instead she hopped off the nest and flapped a short distance over the ground before flying away. In the air she was joined by her mate, and both settled in the grass about two hundred feet from the nest. The next day I approached the incubating bird very cautiously and sat down about eighteen inches from her. She watched me intently for about ten minutes, during which time neither of us moved. She did not fly until I reached my hand toward her. This bird was much tamer than the skittish female on nest 4, which usually left the nest if I came closer than ten feet.

DuBois (7) stated that the eggs were deposited at the rate of one a day and that incubation started with the laying of the last egg. It seemed to me that the birds were somewhat erratic in this respect; for I found that the eggs of a complement were not always deposited on successive days, nor did the female always wait for the completion of the clutch before starting to incubate.

At each of ten nests (numbers 1, 9, 10, 13, 20, 24, 29, 35, 40 and 41) the entire complement hatched within a twenty-four-hour period. At nine other nests (numbers 3, 4, 5, 11, 15, 16, 22, 23 and 28) hatching was prolonged over a two-day period.

At nest 7, the female was incubating on July 26, the day on which she deposited her third egg. On July 27 the female was still incubating three eggs. On July 28 there were four eggs in the nest. A day had been skipped between the laying of the third and fourth eggs, but incubation had begun with the laying of the third egg. Unfortunately the nest was destroyed before incubation was complete, so no hatching information was secured.

At nest 3, the female was incubating three eggs when the nest was located on June 21. These eggs were marked. On the following day a fourth egg was present. It was also marked. The first three eggs hatched on July 3, the fourth egg on July 4.

The female at nest 8 was incubating two eggs on June 29, but her complement was not complete until June 30. This nest was destroyed on July 2. It was thought to be an earlier attempt by the same pair that were later successful at nest 13, although at nest 13 all the eggs hatched within a period of twenty-four hours, which would indicate that this later set had been complete at the start of incubation.

I have data on two pairs that were successful in hatching more than one brood. Nests 3 and 23 were thought to be those of the same pair, as were nests 5 and 22. In each of these four nests hatching required

two days. These two females were consistent in the manner of laying and the time of starting incubation.

The length of the incubation period was twelve days. This was calculated from the laying of the last egg until the time of its hatching, from June 22 to July 4, at nest 3.

A comparison of the incubating procedure between McCown's Longspurs and Snow Buntings showed that females of both species incubate without assistance from the male, but that there is a difference in the amount of time elapsing between the completion of the clutch and the start of incubation. The female longspur either started incubating before laying the last egg of the set or as soon as the last egg was deposited in the nest. In contrast, the female Snow Bunting did no incubating on the day that the last egg was laid, made only spasmodic attempts on the second day, and not until the third day after completing the clutch did she 'incubate constantly' (15).

ACTIVITIES OF THE MALE DURING INCUBATION

While the female incubated the eggs, the male longspur spent a great deal of time (a) guarding the nest from some nearby rock or shrub, (b) engaging in flight-song, or (c) defending his territory, particularly if nests were close together.

Sometimes the male was seen guarding the nest during the female's absence; at other times neither bird was near the nest. M4 was never in the vicinity of the nest when the female was absent. M6 was usually on guard from a pile of stones close to the nest, not only while the female was off the nest, but also while she incubated. He often sang from this stone pile. Whenever I came near the nest he would give an alarm note, at which the female would fly away. During the time I spent weighing the nestlings, he either flew about over the nest or circled about in the grass nearby, making some pretense of collecting food.

DuBois (5) once observed a male longspur feed the female while she incubated.

Tinbergen (15) reported an increase in song of the male Snow Bunting during the incubation period, and one case in which a male mated a second time while his first mate was incubating. Tinbergen interpreted the increase of song as meaning that 'sexual potency' still existed in the male.

Male longspurs sang during the incubation period, but with less intensity than prior to mating. This difference might be explained by the fact that the Snow Bunting tended to be a single-brooded bird, whereas the longspurs commonly raised more than one brood a year.

Sexual behavior of both male and female longspurs seemed to be cyclic. If song is a measure of 'sexual potency,' as Tinbergen suggested, the increased intensity of flight-song by the male longspur prior to the beginning of each new nesting cycle, regardless of whether or not the previous attempt had been successful, was very likely closely associated with enlargement of the gonads in preparation for another mating.

HATCHING OF EGGS

On July 5, 1938, at 6:30 a. m., after flushing the female from nest 9, I found that her eggs were in the process of hatching. One young bird had already emerged from the shell; its down was still wet and clinging to the body. There was a large hole in the side of a second egg, through which could be seen the bill and part of the head of its occupant. A small, circular, cracked area, not yet broken through, was observed in the side of a third egg. Sounds and faint tappings could be detected coming from a fourth egg. When I visited the nest the following morning, all four had successfully hatched.

DESCRIPTION OF YOUNG

The young were hatched blind but not entirely naked, for the dorsal feather tracts were covered with long, buffy down. The skin appeared dark where it was stretched over the body, yellowish where it lay in loose folds. The light, tan-colored egg-tooth was very prominent on the grayish bill. The egg-tooth was shed by the fifth day. The lining of the mouth was bright pink. The feet and legs were pale yellow.

The nestlings were blind for two days. Occasionally on the third day they momentarily opened their tiny, slit-like eyes. By the fourth day they could keep their eyes open for several minutes, although, if undisturbed, they rested quietly in the bottom of the nest with eyes closed. On the fifth day they appeared much more alert, for even though they sat quietly in the nest, they peered over the rim with bright, beady eyes.

When eight days old, the nestlings were no longer content to sit quietly in the nest, but moved about considerably, preening, stretching their necks, raising themselves up and fluttering their wings. By the ninth day, fear instinct was evident. Before this they had not been much disturbed at the weighing process but now they either crouched on the scale with neck drawn down between the scapulars, or fluttered about trying to escape, cheeping constantly. At this the adults became quite alarmed and circled low over the box containing the scales, uttering sharp alarm notes.

The flight of an eleven-day-old bird was very weak, but in another day it could fly thirty feet or more. Tinbergen (15) stated that young Snow Buntings were not able to fly when they left the nest, but walked about with amazing rapidity.

GROWTH OF NESTLINGS

Weight

Nestlings from thirteen nests were weighed daily, from the time of hatching until they left the nests. The following table shows the average daily increase in weight of these birds:

TABLE 2

AVERAGE DAILY INCREASE IN WEIGHT OF YOUNG FROM HATCHING UNTIL FLEDGING

Days	*Number of birds weighed*	*Weight in grams*	*% of increase from time of hatching*
0	13	2.03	
1	39	2.68	32
2	37	4.17	105
3	39	6.31	210
4	34	8.45	316
5	40	10.63	426
6	40	13.05	542
7	34	14.91	634
8	29	16.83	729
9	33	18.13	793
10	16	18.36	804

The weight at hatching varied from 1.6 to 2.9 grams. The nestling lightest in weight (1.6 g.) hatched from one of the small eggs in nest 9 (2 x 1.45 cm.), while the heaviest nestling (2.9 g.) hatched from one of the large eggs in nest 20 (2.25 x 1.6 cm.). An average nestling weighed 2.03 grams shortly after hatching and gained on an average of 1.6 grams a day during the time spent in the nest. The weights of sixteen fledglings varied from 15.5 to 23.0 grams, a difference of 7.5 grams. When the difference in weight at the time of hatching is taken into consideration, and two birds from two nests are compared as to the amount of weight gained during the nestling period, there seems to be a correlation between the growth of the bird and the amount of food supplied by the parent birds.

It was previously noted that incubation might start before the clutch was complete. This resulted in one bird hatching out a day later than

its nest mates. A nestling never overcame such a handicap; in fact, it often did not make normal daily gains in either weight or length. A comparison of the following table and charts will illustrate this point:

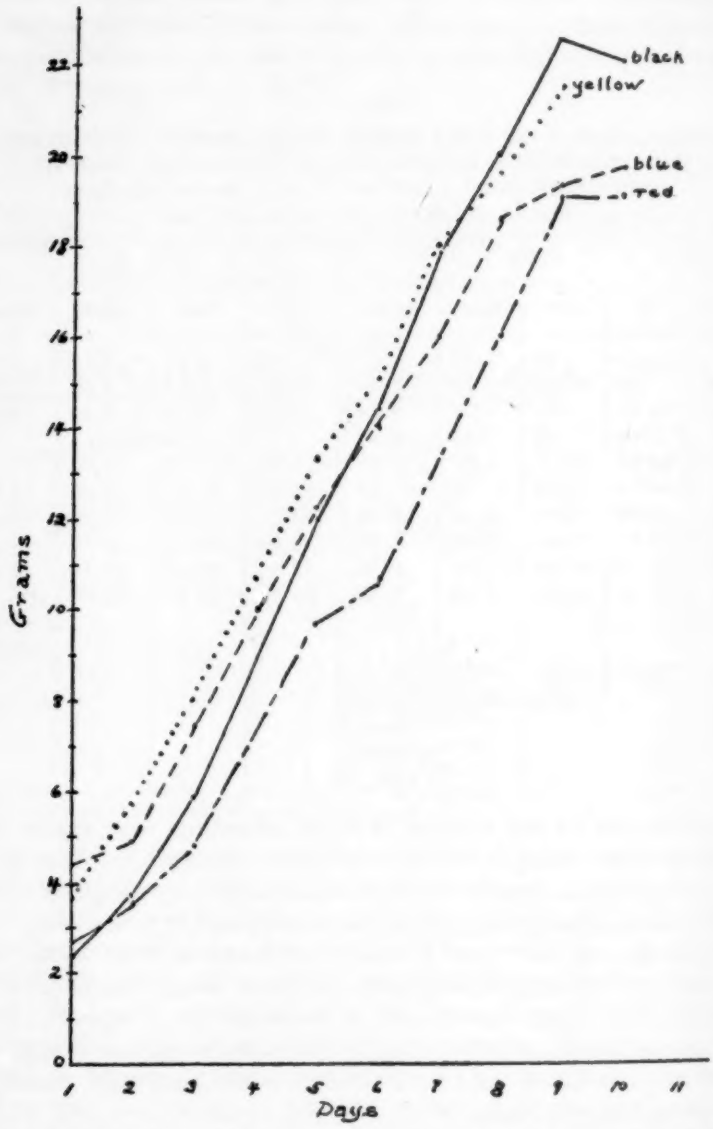
TABLE 3

A COMPARISON OF THE DAILY WEIGHTS OF THE YOUNG IN A NEST WHERE INCUBATION STARTED WHEN THE CLUTCH WAS COMPLETE (NEST 10) WITH ONE IN WHICH INCUBATION STARTED BEFORE THE LAST EGG OF THE SET HAD BEEN LAID (NEST 3)

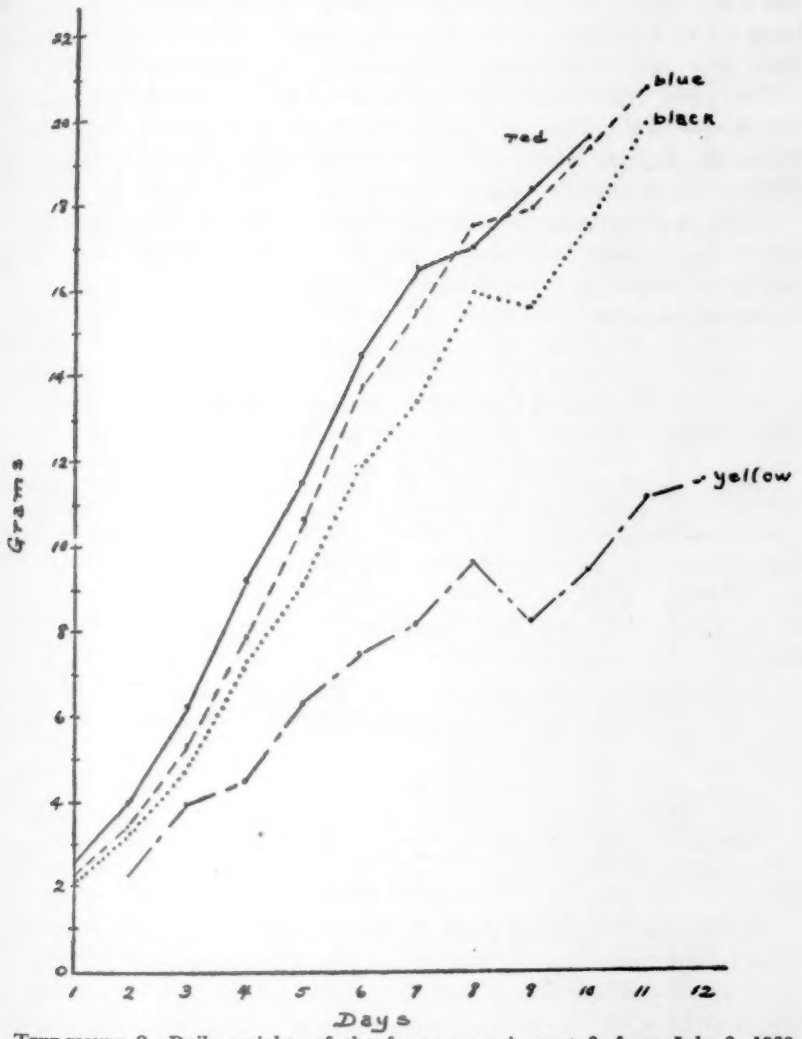
	Nest 3				*Nest 10*			
Days	*red*	*blue*	*black*	*yellow*	*red*	*blue*	*black*	*yellow*
1	2.65	2.27	2.10		2.50	4.20	2.40	3.90
2	4.00	3.30	3.20	2.40	3.45	4.90	3.60	5.70
3	6.40	5.10	4.70	4.00	4.70	7.30	5.80	8.00
4	9.30	7.95	7.30	4.50		(not weighed)		
5	11.50	10.60	9.00	6.40	9.70	12.20	12.00	13.30
6	14.50	13.75	11.90	7.50	10.50	14.00	14.20	15.00
7	16.50	15.50	13.30	8.20	13.20	16.00	17.70	18.00
8	17.00	17.50	16.00	9.70	16.00	18.30	20.00	19.60
9	18.10	17.90	15.70	8.20	19.00	19.30	22.50	21.50
10	19.50	19.30	17.40	9.50	19.00	19.50	22.00	(left before being weighed)
11	(left)	20.90	20.00	11.20				
12		(left)	(left)	11.50				
13				(dead outside nest)				

The chances for the survival of these underlings were closely associated with the amount of food that they received. In cases where the adults did not respond readily to their weaker food calls, they died either before leaving the nest (as in nests 24 and 28), or shortly afterward (as the one from nest 3, which was found dead six inches from the nest). Those which were well fed by their parents fledged successfully a day later than the rest of the brood (as at nests 4, 11 and 28). At nest 5, the youngest bird left the nest the same morning as its nest mates, probably because this bird weighed only 2.8 grams less than the other two young in the nest.

After the young birds left the nest they did not continue to gain weight at the same rate as during the nestling period. One immature bird (band number 138-2830) was captured two days after leaving the nest. At this time the bird weighed 20.1 grams, a gain of but 1.5 grams in the two days.



TEXT-FIGURE 1.—Daily weights of the four young in nest 10, from July 13, 1938, through July 22, 1938.



TEXT-FIGURE 2.—Daily weights of the four young in nest 3, from July 3, 1938, through July 13, 1938.

SIZE

One nestling, measured before its down was entirely dry, was one and one-fourth inches long. The young in nest 20, which were above average in weight, were also above average in length. These three birds, shortly after hatching, measured 1.75, 1.63 and 1.50 inches, respectively, whereas an average length of thirteen day-old birds was

but 1.54 inches. At the time of fledging, young longspurs measured from 3.5 to 4.0 inches in length, the average of five being 3.75. The daily growth in length was approximately 0.25 of an inch.

The wing (measured from the bend to the tip of the primary) of one newly hatched young measured 0.25 of an inch. Average measurements of eight young showed that the wing grew to a length of 2.03 inches before the birds left the nest.

The legs of seven birds were measured. At two days the tibia measured 0.5 of an inch in length; at ten days it measured one inch. The tarsus and toes together measured 0.63 of an inch at two days; 1.56 inches at ten days.

TABLE 4

AVERAGE BODY MEASUREMENTS OF NESTLINGS

Days	*Number of birds measured*	*Length of body in inches*	*Length of wing in inches*	*Length of tibia in inches*	*Length of the tarsus and toes in inches*
0	1	1.25	0.25		
1	18	1.54			
2	17	1.81	0.43	0.50	0.625
3	21	2.06	0.52	0.625	0.875
4	16	2.38	0.63	0.75	0.94
5	13	2.51	0.82	0.75	1.13
6	17	2.79	1.22	0.875	1.19
7	10	3.10	1.32	0.875	1.25
8	12	3.26	1.64	1.0	1.365
9	13	3.46	1.94		1.5
10	5	3.75	2.03	1.0	1.562

FEATHER GROWTH

At the time of hatching all of the dorsal feather tracts of the nestlings were covered with a pale, buffy down ranging from three-eighths of an inch to one-half an inch in length. On the third day, tiny points of the sheaths of the developing quill feathers became visible under the skin. These became more prominent on the fourth day, especially on the dorsal, femoral, ventral and humeral tracts. In a few cases tiny feather tips were noted breaking from the sheaths of the nuchal, humeral and femoral tracts. By the sixth day, feather tips had broken from all sheaths except those on the capital tract. Another day was needed for the head feathers to emerge, otherwise, on the seventh day the bird appeared well feathered. Down still clung to the head and occasionally to some of the back feathers on the eighth day. The

feathers on the ventral tract were not yet long enough to cover completely all ventral apteria, but did so by the tenth day.

The wing feathers developed at a slightly different rate from those on the body proper. The developing flight feathers, enclosed in their sheaths, appeared on the wings on the second day. These sheaths grew from one-sixteenth of an inch on the third day to one-fourth of an inch by the fifth day. On the sixth day, feather tips had broken from the sheaths on the primary coverts and on the inner margins of the secondaries. On the following day, these feather tips extended from one-eighth to one-fourth of an inch beyond the sheath, which was now one-half an inch long; the primary feathers had grown one-sixteenth of an inch beyond the sheath. By the time the bird was ready to leave the nest, the feathers of the secondaries protruded one-half an inch beyond the end of the sheaths and those of the primaries one-fourth of an inch. The primary feathers of a bird captured when eighteen days old measured two inches in length.

The caudal feathers were the slowest of all to grow. The nestlings were six days old before the tail feathers could be measured. At that time the feathers had grown one-sixteenth of an inch beyond the sheath, which also measured one-sixteenth of an inch. Growth continued slowly: 0.125 of an inch on the seventh day, 0.189 on the eighth day, and 0.375 on the tenth day. The tail of an eighteen-day-old bird measured one inch in length. At this time the characteristic color pattern of the tail was clearly indicated.

CARE OF THE YOUNG

Both parent birds cared for the young during the nestling period, and became increasingly more solicitous as the young developed. An incubating female would normally leave the nest and settle in the grass some distance from her nest during my visit to it. The brooding female would leave the nest if disturbed, but fed close by. By the time the nestlings were nine days old, both adults kept close to the nest during my visit, alternately feeding nearby and circling low over the nest, uttering sharp calls. On the day the young left the nest, both adults continually flew about me calling, *chip-pur-r-r-r, chip-pur-r*. They were just as excited at my intrusion on the following day, although later than this I did not notice any anxiety on the part of the adults, unless I accidentally flushed a young bird.

Normally the young left the nest on the tenth day. However, one brood (nest 3) remained in the nest until the eleventh day while two broods (nests 11 and 16) left on the eighth day. The young at eight

days were quite helpless, so it is possible that the adults were disturbed by my daily visits to their nests and coaxed the young birds out.

The female brooded most of the first two days after the young hatched, but she was relieved at intervals by the male. From the third day on, more time was spent by both adults gathering food for the young and less time brooding them. During showers the female brooded the nestlings even after they were well feathered. At nest 22, where the female had either deserted or been killed while away from the nest, the male fed the young, but apparently failed to brood them during a downpour, for the young were found wet and dead after the rain.

From an observation blind, F6 was seen to straddle the nest while brooding. She placed one foot on either side of the rim of the nest.

On the night of July 10, 1938, my husband and I visited the field at ten o'clock. We had previously marked the nests so that they could be found easily in the dark. When a nest was located, a flashlight was turned on it. The young birds in nest 9, which were five days old, were being brooded. The adult bird left the nest, but the young birds did not open their eyes. The seven-day-old nestlings in nest 3 were not being brooded. The adults were on the ground in the immediate vicinity. The male, evidently disturbed, sang a short snatch of song. From this night visit it seems that the young birds are brooded at night until they are well feathered, or until about six or seven days old.

FEEDING THE YOUNG

The nestlings were fed insects from the first, never regurgitated food. Moths and grasshoppers furnished the bulk of the food, with the following kinds of grasshoppers predominating: *Arphia pseudonietans, Camnula pellucida, Melanoplus femur-rubrum,* and *Trimerotropis* sp. The young Snow Buntings were fed only animal food such as small Lepidoptera and Diptera (15).

Both male and female fed the young. The adults gave a call whenever they approached the nest with food. The young responded at once with a continuous twittering and stretched their gaping mouths toward the side of the nest from whence the adult's call had come.

Although both parents fed the young, they did not always assume an equal share of the task. The following observations, made from blinds set up before the nests, may not be entirely accurate from the feeding standpoint because in some of the birds the fear of the blind overcame the urge to feed the young.

During the three hours which I spent in a blind at nest 5 only the

male came to feed the young. He fed them alternately, giving each bird two portions. The female was in the vicinity with food in her bill, but she did not come to the nest.

The opposite situation occurred at nest 13. On July 26, this nest was observed for four hours from a blind. In this case it was the female which fed the young and brooded them during a light shower. The male guarded from his selected rock, but did not approach the nest while the blind was there. However, seven days after this brood fledged, one of the young was caught and placed inside a trap. This immature bird was crippled because of a leg injury. The male fed it several times before the trap was sprung, although when a nest trap had been placed over the nest only the female would enter it to feed the nestlings.

At nest 20, the male came immediately to feed the young after a trap had been placed over the nest. In this case it was the female that would not enter the trap. Later on this male either deserted or was killed and left the female alone to feed the brood during the last four days of the nestling period. Desertion might be explained as due to molting; for when M13 was banded on August 8, molting of the primaries was already in progress.

At nest 24, both the male and female were seen feeding the brood two days after the young had left the nest. At this time I did not notice any partitioning of the brood between the adults, such as Tinbergen (15) noted with Snow Buntings. Both adults fed the young which were scattered about. Later on—in the case of immature birds which had been out of the nest for about a week—only one adult made its appearance when a young bird was flushed.

The food call of the young longspurs changed from the continuous chippering of the nestling to the shriller, intermittent call of the fledgling. Similarly young Horned Larks and Snow Buntings were reported developing a particular food call, prior to leaving the nest, which varied considerably from the call used during the preceding time spent in the nest (15).

NEST SANITATION

Excrement was removed from the nest by the parent birds. The nests were kept quite clean until the last two days of nest life. By this time the young so filled the nest cavity that an occasional excrement sac was often overlooked. After the young fledged, the membranous sac no longer enclosed the feces. Tinbergen (15) stated that a change in the constitution of the feces, *viz.*, the loss of the membrane, occurred the day before young Snow Buntings left the nest cavity.

Ants were omnipresent. From the observation blind at nest 13, the female was seen picking them from the young and out of the nest.

NESTING SUCCESS AND FAILURE

Of the three years, 1938 proved to be a more successful one for the longspurs than did either 1939 or 1940. Climatic conditions in 1938 were favorable during the whole of the breeding season; temperature and amount of precipitation were only slightly above normal when compared to averages for the past fifty years. In 1939, the hot, dry weather coming early in July probably caused a shortening of the nesting season, as no new nests were found after July 8. In 1940, while the preceding winter and spring were close to normal, June turned very warm, dropped below freezing on the 9th, and then turned hot. The latter part of June and the month of July, 1940, were the hottest and wettest on record. August turned abruptly cool. No new nests were found after July 7. In addition to the early hot weather, a badger and a weasel spent some time in the field. This

TABLE 5

A COMPARISON OF THE SUCCESSFUL, PARTIALLY SUCCESSFUL, AND UNSUCCESSFUL NESTS DURING 1938, 1939 AND 1940

	Number of nests	*Percentage*	*Number of eggs laid*	*Number of eggs hatched*	*Number of young fledged*	*Average number of young fledged*
Completely successful nests						
1938	6	24	23	23	23	3.83
1939	2	28.5	7	7	7	3.50
1940	3	23	9	9	9	3.00
Partially successful nests						
1938	8	32	30	27	22	2.75
1939	3	42.9	9	7	7	2.33
1940	5	38.5	15	7	3	0.60
Unsuccessful nests						
1938	11	44	39	12	0	0
1939	2	28.5	5	0	0	0
1940	5	38.5	16	0	0	0
Total						
1938	25	100	92	62	45	1.8
1939	7	100	21	14	14	2.0
1940	13	100	35	16	12	0.92
Grand total	45		153	92	71	1.58

combination of circumstances probably explains the large number of nesting failures and the lack of late nests in 1940.

A total of 153 eggs were deposited in 45 nests, averaging 3.4 eggs per nest. Of these 92, or 60 per cent of the total number laid, were hatched; 71 birds, representing 46.4 per cent of the eggs laid, were fledged, giving an average of 1.58 birds per total nest, or 3.5 birds per successful nest. This information is compiled in Table 5.

RELATION TO OTHER ANIMALS

The native mammals most commonly found in the field were the white-tailed jackrabbit, *Lepus townsendii townsendii,* the pale striped ground squirrel, *Citellus tridecemlineatus pallidus,* the Wyoming ground squirrel, *Citellus richardsonii elegans,* and the white-tailed prairie dog, *Cynomys leucurus.* Of these, the ground squirrels and prairie dogs could be classed as predators. The longspurs evidently recognized these rodents as marauders, for on several occasions the birds were seen hovering over a ground squirrel, chirping and darting at it in an effort to drive it away from the nest site. Predators which paid occasional visits were a cat, a badger, *Taxidea taxus taxus,* and a weasel, *Mustela arizonensis arizonensis.*

In regard to other birds, the longspurs nested in harmony with Desert Horned Larks, *Otocoris alpestris leucolaema,* Western Mourning Doves, *Zenaidura macroura marginella,* Howell's Nighthawks, *Chordeiles minor howelli* and Western Vesper Sparrows, *Pooecetes gramineus confinis.* In an adjoining field were Western Meadowlarks, *Sturnella neglecta* and a pair of Mountain Plovers, *Eupoda montana.* These birds undoubtedly competed with the longspurs for food, since they all fed mainly on insects during the breeding season; but no fighting between the different species was witnessed even when nests were fairly close together.

A pair of Swainson's Hawks, *Buteo swainsoni,* and a pair of Marsh Hawks, *Circus hudsonius,* were frequent visitors to this field. They swooped over the field in search of rodents, quite indifferent to the smaller birds. A Prairie Falcon, *Falco mexicanus,* occasionally visited the field, but did not seem to bother the longspurs. Sometimes the longspurs ignored the hawks, but oftener a group of birds would rise and twitter noisily as they flew around the hawk.

A pair of Western Crows, *Corvus brachyrhynchos hesperis,* also used this field as a hunting ground. Although I did not actually witness any depredations by the crows, it is my belief that they were responsible for the disappearance of some of the eggs and young of the

smaller birds. Two Mourning Dove nestlings were found decapitated, with the sides ripped open and the liver picked away. One fully fledged longspur was also found decapitated.

Insects were numerous. Some groups were neutral while others, namely moths and grasshoppers, furnished the bulk of the food supply for both young and adult longspurs. The following groups of insects were common in the field: ants, flies, robber flies, mosquitoes, short-horned grasshoppers (Acrididae), and among the beetles, Carabidae and Tenebrionidae.

COMPARISON OF LONGSPURS AND SNOW BUNTINGS

When the behavior of McCown's Longspurs was compared with that of the closely related Snow Buntings, the two species were found to behave similarly in the following respects: The arrival of the males on the breeding grounds preceded that of the females. The male established the territory and, after mating, the female built the nest or nests within the territory. Territories were defended by the males against competing males of the species. Incubation was performed by the female. The male assisted in feeding the young. The young birds were fed insects. The food call of the nestlings varied from that of the fledglings. The following dissimilarities were noted: Longspurs usually remained on their territories, but the snow which covered the Snow Bunting territories at first forced them to return to neutral foraging areas each day. A newly mated Snow Bunting stopped singing, but sang again whenever his mate disappeared. The male longspur continued singing, but engaged in fewer flight-songs immediately after mating. The female longspur collected the nesting material from within the territory; in contrast the female Snow Bunting, accompanied by the male, wandered in search of the proper material. Longspurs nested in the open; Snow Buntings in rock crevices. The clutch of the single-brooded Snow Bunting contained five or six eggs; longspurs tended to raise more than one brood a year, and sets contained either three or four eggs. Song of the male Snow Bunting increased in intensity during the incubation period; song of the male longspur increased prior to each new nesting cycle. After young Snow Buntings left the nest, the brood was divided between the adult birds.

SUMMARY

Male McCown's Longspurs arrived in southeastern Wyoming early in April and became common by the third week in April. At this time the resident males began to select territories.

Female longspurs arrived after the middle of April.

Longspurs were gregariously inclined even during the breeding season; thus territory became important in order to prevent overcrowding.

The male proclaimed his right to a territory by a conspicuous flight-song.

Song lasted from the time a definite territory had been selected until the young hatched, and was repeated for each new nesting cycle.

The male defended his territory by song in combination with threatening actions and aërial fighting.

Territorial defense was directed against other male longspurs who were competing for territory, but not against non-competing males, nor against males of other species frequenting the area.

Courtship by the male longspur consisted primarily of singing from perches within the territory, of raising the wing to display its white lining, and of bowing to the female.

Nests were built by the females, in shallow depressions in the ground, beside clumps of grass or low shrubs. Nests were commonly constructed of grasses collected by the female from the territory. An average weight of the material used was nine grams. Nests were not used a second time.

Nests were usually wider than deep. Average measurements of six nests were: 3.4 inches, outside diameter; 2.46 inches, inside diameter; and 2.08 inches, depth.

The complement of eggs was either three or four, occasionally five. First sets were found complete between May 9 and May 20. The latest date for a full set of eggs was August 6.

Eggs varied in ground color from white to pale olive, and were marked with various combinations of speckles, spots, lines or scrawls of lilac, rusty-brown, or mahogany. They were usually oval in shape and averaged 2.055 by 1.546 cm. in size.

The average weight of an egg in a 3-egg set was 2.4 grams; in a 4-egg set, 2.37 grams; and in a 5-egg set, 2.28 grams.

Eggs lost approximately 0.05 of a gram daily, or 20 per cent of their weight during incubation.

The incubation period was twelve days in length.

Incubation was performed by the female. During this time the male engaged in flight-song, defended the territory, and guarded the nest.

In some cases eggs were deposited at the rate of one a day and incubation began with the laying of the last egg; in other cases the eggs

were not deposited on successive days, nor did the female always wait for the completion of the clutch before starting to incubate.

Long, buffy down covered the dorsal feather tracts of the newly hatched young.

Nestlings were blind for two days. By the fifth day they could keep their eyes open.

During the first half of the nestling period the young sat quietly in the nest, but during the last half of the period much time was spent exercising.

Nestlings increased in weight from an average of 2.03 grams at the time of hatching to 18.36 grams at the time of fledging, a gain of 1.6 grams a day.

As to measurements: the body increased from a length of 1.25 inches at the time of hatching to 3.75 inches at the end of the ten-day nestling period; the wing, from 0.25 inches to 2.03 inches; the tibia, from 0.5 of an inch on the third day to 1.0 inch on the tenth; and the tarsus and toes together, from 0.6 of an inch on the second day to 1.5 inches on the tenth.

As to feather growth: feather sheaths became prominent on the body the fourth day. By the time the young were ready to leave the nest the feathers were long enough to cover all apteria. Capital feathers made their appearance a day later than the body feathers, the wing feathers a day earlier. By the tenth day the feathers of the wing had grown from one-fourth to one-half an inch beyond the sheaths. Caudal feathers were the slowest to grow. The tail was less than one-half inch long when the bird left the nest.

The young birds left the nest on the tenth day.

When incubation started prior to the completion of a clutch, it resulted in one bird hatching out a day later than the rest of the brood. Very often this bird did not grow as rapidly as the others and so could not always leave the nest successfully.

Both male and female fed and brooded the young. After the nestlings became well feathered they were still brooded during showers but not at night.

The young were fed mainly on insects.

The adults called whenever they came to the nest with food. The young answered with a continuous twitter. The food call of the young became shriller and was uttered intermittently after fledging.

Excrement was removed from the nest by the adults.

There were 153 eggs laid in 45 nests, 92 eggs hatched, and 71 young fledged, an average of 1.58 fledglings per nest. The birds were more suc-

cessful in 1938 than in 1939 or 1940, probably due to the less favorable climatic conditions during the latter years, and to the presence of more predators in 1940.

The relationship between the longspurs and the majority of the other birds and mammals found in the field was a neutral one. Crows, ground squirrels, and prairie dogs as well as the badger and the weasel were considered predators. Some of the insect groups were neutral; others furnished food for both young and adults.

The behavior of the longspurs and the closely related Snow Buntings was compared.

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1516 Rainbow Ave.
Laramie, Wyoming

WEIGHTS AND PLUMAGES OF THE HORNED LARKS OF CENTRAL NEW YORK

BY WILLIAM MONTAGNA

THIS study was made mostly from birds taken near Ithaca, Tompkins County, New York. Here well drained, windswept fields offer an ideal wintering, as well as nesting, environment for Horned Larks, *Otocoris alpestris.* The three races of this well-known species, *alpestris, hoyti* and the most abundant and nesting *praticola,* have been found here in some numbers. Gayle Pickwell (1931) made rather exhaustive studies of *O. a. praticola* in the environs of Ithaca but the recent observations of the author deal with things little touched by him. This study is divided into two parts: weight and plumage variations.

The author is greatly indebted to Professors A. A. Allen and George M. Sutton for their many helpful suggestions and guidance in this study. He also wishes to thank the graduate students of the Laboratory of Ornithology of Cornell University for their kindness and helpfulness.

WEIGHT

This study was carried out during the years of 1938, 1939, 1940, and the spring of 1941. Data were collected from birds taken as museum specimens, and birds trapped for banding. Thus I have been able to gather interesting notes on the weights of *O. a. praticola* as well as a few of *O. a. alpestris.* The weights of *O. a. hoyti* are few and so much like those of *alpestris* that I need not record them. Although the weights of these races are extremely variable and occasionally overlap, the average for *alpestris* is in all cases higher than that of *praticola.* Data collected are perhaps too few to enable one to draw definite conclusions, but may prove interesting.

Thus we have not only an average of the weights of *O. a. praticola* compared with those of *O. a. alpestris,* but an analysis of the weight variations, especially of *praticola,* throughout the year. These observations are so much like those made by Nice (1937) on the Song Sparrow (*Melospiza melodia*) and by other workers, that they require but little explanation. In gathering these weights no distinction was made between live birds and freshly killed ones. Doubtless, there must have been a slight loss of weight in the dead specimens, but it was not tabulated. Also, no effort was made to weigh the birds beyond tenths of a gram. Since this study was not made to show daily fluctuations of weight, no notice was taken of the time of the day in

TABLE 1.

WEIGHTS IN GRAMS OF *O. a. praticola*

Males			*Females*	
month	*number*	*weight*	*number*	*weight*
January	10	36.7–49 (43.4)	1	34.7
February	33	30.6–45 (38.3)	6	31.1–38.5 (35.4)
March	76	33.2–44.5 (37.2)	71	31 –38.8 (34.3)
April	9	35 –36 (36)	5	37 –39 (38.2)
May	2	34.5–36.4 (	2	36 –39 (
June	5	30 –30.9 (30.3)	2	30.3–30.9
July	4	29 –31 (30.8)		
August	5	33 –36 (35.2)		
October	2	35 –35.8		
December	18	36.3–43.5 (40.4)		

TABLE 2

WEIGHTS IN GRAMS OF *O. a. alpestris*

Males			*Females*	
month	*number*	*weight*	*number*	*weight*
January	3	45.2–49 (46.6)		
February	14	42.7–55 (48.2)	1	49.4
March	48	41 –59.5 (49.2)	18	39 –41 (40.8)
November			1	37.8
December	1	43	1	45

which birds were weighed. On the whole, the study is a gross seasonal one, rather than one showing minor daily fluctuations.

The maximum weight was attained by *praticola* in late December, January and February. This weight gradually decreased from March until July when the lowest weights were obtained. Occasionally, among the birds weighed, there were individuals that were atypical; for instance, one male, taken in February, weighed only 30.6 grams, almost as low as the lowest spring weight. One female taken in March, 1939, weighed 25 grams. This was so low that I did not include it in my calculations. Three very heavy January males, weighing 47, 48 and 49 grams, do not seem typical for *praticola* but more what one would expect in *alpestris*. The lightest male *praticola* was a July bird which weighed only 29 grams. This is 66.5% of the average weight of the three very heavy January birds.

I could find no positive correlation between the weights of the individual birds and their measurements. Two of the January males with wing measurements of 102 and 103 mm., respectively, weighed 48 and 49 grams. The very small female which weighed 25 grams had a wing which measured 96 mm.; this is perfectly normal. Other females banded in March, 1940, measured as low as 93 mm. while their weight was never lower than 31.3 grams. March males weighing only 36 grams had wing measurements of 108 and 109 mm. It was evident that the birds' weight depends somewhat on the amount of stored fat, rather than entirely on structural differences. June and July birds, which are nearly free of fat, are very light. I have taken as much as six grams of fat from the skin, alone, of specimens taken in January. Winter larks are completely enveloped by a thick layer of fat, particularly on the abdomen, base of the neck, and sides of the breast.

It is difficult to account for such an abundance of fat when food seems so scarce; yet the birds seem to be very well fed. Baldwin and Kendeigh (1938) have shown that there is "an inverse correlation between body weight and air temperature. The bird's weight increases with drop in temperature, and vice versa."

PLUMAGE VARIATIONS

Dwight (1890), in his review of *Otocoris alpestris,* says of *praticola:* ". . . with a pale yellow chin, which is seldom bright, and is often white." Oberholser (1909), says: "Individuals vary much in the shade and intensity of the color of the nape, rump and bend of wing, these differences also conspicuous on all the light areas of the upper parts. The eyebrow usually white, though occasionally tinged with yellow; the throat, on the other hand, is rarely without at least a trace of this color." As one may see from these statements, the general colors of these birds are rather variable and such parts as the throat and superciliary line exhibit extremely plastic quality. The color of the back may vary so that no two individuals are *really* alike. They may range from definitely pinkish gray with no apparent streaking to dark brown and heavily streaked.

Looking over a large series of thoroughly clean, locally collected, late winter birds, one finds skins with throats ranging from almost pure white to bright yellow. Notes taken on over three hundred male *praticola* reveal the following results: 2% of the specimens have the throat almost pure white; 20% have the white throat washed with a faint yellow tinge; in 48% it is light straw colored; and in the remaining 30% it is bright yellow. One hundred and twenty females,

on the other hand, show 14% with a pure white throat; in 48.2% it is whitish with a faint yellow wash of varying degrees; and in the remaining 37.2% the throat is yellow, from light to bright.

The foreheads of 75.6% of the males are white, and yellowish on the remaining 24.4%. The females show a predominance of white on the forehead, although some of them have a yellow wash.

The superciliary line of male *praticola* is, for the most part, white (88.4%). However, the yellow of the forehead of many individuals extends over the eye, and at times covers the entire line; 12% have either half or the entire line of this color. The superciliary line of the females is in nearly all cases white. The portion directly over the eye may, at times, be yellow, but in no case is the hinder portion of this color. This portion, however, may often be washed with buff. It is possible that some of the individuals collected are intergrades between *alpestris* and *praticola,* but to me it appears rather that the yellow of the eye-stripe is extremely variable.

It seems also worthy of note that the streaking of the breast and flanks of *praticola* is not, so far as I can tell, due to age, but rather to the fact that this, too, is a variable character. Birds with naturally streaked breasts and flanks, such as Song Sparrows (*Melospiza melodia*) and Sharp-tailed Sparrows (*Ammospiza caudacuta*) regularly exhibit similar variability in the amount of streaking, so I am inclined to consider this an individual variation. Assuming that old birds have longer halluces than young ones, I tried to correlate the amount of streaking with the length of hallux, but obtained indecisive results. There appeared to be little correlation.

In order to find out if the variability of color of feathers occurs within the individuals as well as within the race, I carried out several experiments with captured examples of *praticola.* For the first experiment I used twenty birds. These I placed in four cages, five birds in each cage. In one cage I placed birds with very yellow eye-stripes and throats, so as to approach *alpestris* in this character; in another cage were placed individuals with yellow throats and white eye-stripes; in the third cage were birds with faintly yellow throats; and for the fourth cage I selected five birds with white throats. For the first experiment, on March 16, I plucked the right superciliary line and right half of the throat of all of the birds.

Within two weeks the feather-sheaths of the plucked portions were evident on all of the birds and within one more week the tips of the sheaths were beginning to burst. At the end of 35 days the feathers seemed to be completely grown out. During the experiment the birds

were kept on a well-balanced diet of timothy seeds, millet, cracked grain, gravel, cod-liver oil, etc.

The results of this first observation were uniform. The new feathers could hardly be distinguished from the old ones. The white-throated birds acquired white feathers; the yellow ones, yellow feathers. The fact that only after close observation could I tell the difference between old, worn feathers and those just grown in, shows that wearing of these feathers does not affect to a great extent the color of these parts. The new feathers of the white-throated birds revealed, on close inspection, a very faint wash of yellow which was lacking on the old feathers. Also, in the yellow birds the tips of the new feathers had a minute brownish tuft.

Once more I plucked the birds. On one-half of them I replucked the right side with the newly grown feathers and on the remaining ones, the left side with the old feathers. The period of growth was of more or less the same duration as in the previous experiment. Within one month the feathers grew out almost completely.

The results were as in the first observation. On those birds which had new feathers on both sides of the throat and eye-stripe I could not find any difference between the feathers which were two months old and those which had just grown. Once more I plucked ten birds. This time I chose the intermediate birds, five of these with white throats with scattered yellow blotches. I made a diagram of each bird's throat to indicate the position of the yellow spots. The results were as I expected; the yellow spots came out in their proper places.

With five of the birds I had plucked the right side of the breast and the right flank. The newly grown feathers here, however, showed a marked difference. The new feathers displayed a delicate brownish wash of different intensity, which was lacking in the old feathers. Even the streaking was more copious for the most part. Two of my five males, however, showed little brownish wash and streaking on the breast and flank. I plucked the old feathers of the left side, but they grew out as on the right side.

In the light of these pluckings one may surmise that the character of the yellow parts, although variable within the race, is deep-seated in the individuals.

Since the race *praticola* is, by all means, the most abundant in Ithaca I had to limit my experimentation to it. However, the following notes taken on *alpestris* may be worthy of record. Generally speaking, specimens of *alpestris* should not offer difficulty in identification. Indeed, bright individuals are readily recognizable even in the field,

with their rich yellow throats and eye-stripes. Such birds, I understand, are typical, but it has been my experience to find richly colored birds as commonly as dull or almost white-throated ones; so, perhaps they are not the typical ones. Among specimens collected here in Ithaca, as well as those in the American Museum of Natural History (collected for the greater part on Long Island), the National Museum, Carnegie Museum (collected mostly in Labrador), and the Baffin Island birds collected by J. Dewey Soper, I find such a variety of coloration of yellow parts that I am often puzzled as to whether the birds are *alpestris* or *hoyti*. It is no wonder that Soper (1928) had such difficulty with the identification of his Baffin Island material. Many of the birds observed have not only the yellow of the throat blotched with white, but the superciliary line, which in all cases should be bright yellow, white.

Often field identification of these birds is nearly impossible. Even the keenest observer would fail to distinguish a white-throated Manitoba or Labrador bird from the white-throated *hoyti*. So, I rather disagree with Walker and Trautman (1936) that *hoyti* is "not difficult to identify in the field." Careful examination of more than two hundred specimens shows that *alpestris* is not only difficult but at times impossible to tell from *hoyti*. Indeed, only too often, the individual variations of these two races are greater than their subspecific characters.

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Department of Zoology
Cornell University
Ithaca, N. Y.

WEIGHTS OF SOME WESTERN SUBSPECIES OF HORNED LARKS

BY WILLIAM H. BEHLE

THE accumulation of weight data for birds has been a relatively late development in ornithology. This is indicated by Baldwin and Kendeigh (Auk, 55: 416–467, 1938) in their summary of the information available on the subject. It seems that much of the data pertaining to the weights of birds thus far accumulated has been contributed either by bird banders or by investigators carrying on special work, often of an experimental nature, with particular species of birds. A third source is that afforded by collectors and preparators through the practice of weighing specimens in the field and recording the data on the specimen tags. From this activity a wealth of data is to be found on specimens in institutions whose routine policy it is to weigh all specimens prepared.

Some years ago while engaged in a study of the distribution and variation of the western subspecies of horned larks (*Otocoris alpestris*) at the California Museum of Vertebrate Zoology, I tabulated all the weights available from the hundreds of skins examined, many of which I had personally collected and weighed. These data, while not nearly so complete as may be desired, nevertheless indicate sex, age, and geographic and seasonal variations in weight for the species. I have felt it worth while to place on record the data thus assembled, especially since Baldwin and Kendeigh (*op. cit.*) apparently had no data pertaining to horned larks for their summary and analysis. Furthermore, in few cases does there appear to be so much data available for different subspecies of a variable species as in the case of these western forms of this species.

The two sexes of horned larks show differences in their weights which correspond roughly with the degrees of difference between the sexes in measurements of extremities. Females, being smaller, weigh as a general rule less than males. The weights of 433 males representing nine different races and without respect to season, age or locality average 30.1 grams. The average likewise for 258 females is 27.9 grams. Thus there is a difference of 2.2 grams in favor of the males. This difference holds true for practically all of the subspecies as can be seen in the accompanying general summary tables (nos. 4 and 5).

The single exception has to do with the subspecies *arcticola*. The weights of 11 females of this race average 0.8 grams more than the weights of 27 males. Ten of the females were breeding birds; only

one was a winter specimen. There was no appreciable amount of fat on any of the birds when collected, according to the collector's notes. Of the 27 males, 23 are breeding birds and four are birds taken in winter. So far as season is concerned, then, the weights of the two sexes are somewhat comparable. One might have some justification for concluding that there is no sexual difference in body weight in this race and that the species, therefore, shows geographic variation in this character, were it not for the possibility that the females were about to lay eggs when taken and hence actually weighed more than they would have weighed at other times of the year. That the females were in the laying period is further indicated by the collector, Mr. T. T. McCabe, to whom I am indebted for the information.

A matter to be considered here is whether there are differences in body weight between the two sexes in the juvenile stage. In a series of nine juveniles taken in the White Mountains, Inyo County, California, five are males and average 25.1 grams, while four are females and average 24.7 grams. In seven juveniles of the same race from the Mono Lake region, Mono County, California, four males average 27.7 grams and three females, 26.1 grams. In the total of both cases, the ten males average 26.4 grams as against 25.4 grams for the eight females. These data suggest that the sexual difference in body weight commences to be apparent, in this one subspecies at least, in the juvenile stage.

Juveniles, as might be expected, weigh less than adults; at least this is indicated for one subspecies where data are available. Five juvenile males from the White Mountains, Inyo County, California, have an average body weight of 25.1 grams as compared to an average of 28.3 grams for ten adult males. Both juveniles and adults were taken not only at the same place but about the same time as well. Four juvenile females average 24.7 grams as against 26.4 grams for eleven adult

TABLE 1

AVERAGE BODY WEIGHTS OF MALES OF FOUR SUBSPECIES AND TWO AGE CATEGORIES

	Adults		*1st year*	
	No.	*Weight*	*No.*	*Weight*
merrilli	8	30.9	6	31.1
lamprochroma	10	30.5	15	30.5
rubea	8	29.7	10	29.0
actia	10	29.9	4	28.0

females likewise taken at the same place and the same time. This indicates a difference in body weight between these two age categories in each sex. The juveniles furthermore were all in the same stage of development, having been taken at a time immediately preceding the commencement of the postjuvenal molt.

One might also expect some differences in body weight between first-year and adult age groups, but such does not appear to be the case. The pertinent data in this respect are summarized in Table 1, and it will be seen that the two categories have very similar weights.

That there are subspecific differences in body weights for some of the many different western races is indicated by the data in Tables 4 and 5. Comparing the total average weights, it will be seen that *arcticola* is by far the heaviest and *enertera* the smallest of the races studied. This focuses attention on a trend from heavy birds in the north to lighter birds as one goes south. This accompanies a decreasing trend in size from north to south.

Finally, there is the consideration regarding seasonal trends in body weight. The comparative data, with one exception, show no indications that the weights of females taken during the breeding season are any greater than those of winter-taken females. In the case of *arcticola*, the winter weight appears to be considerably greater, but little significance is to be attached to this since only one winter-female weight has been available. In contrast, the males are, in the majority of cases, distinctly heavier in winter than they are in summer. Since the males show pronounced seasonal fluctuations and the females do not, the females, then, have weights that show a closer approach to those of the males in the summer than they do in the winter.

In the case of the males, the increase in weight in the winter seems to be very definitely tied up with an accumulation of fat. Many specimens in the Museum of Vertebrate Zoology have the entry "fat" marked on the tags of winter-taken specimens. Similar entries are to be found in collectors' field notebooks. Less is known about the fat condition of the females. While females do not seem to fluctuate greatly in weight throughout the year, it is probable that they are actually fatter during the winter. It may be that weight fluctuations are not indicated by the data at hand because the birds collected had added weight because of developing eggs. If such were the case, one would expect a decrease in weight immediately after the egg-laying stage and the period of nesting activity, but data are lacking that would settle this point.

The question arises at this point as to whether or not the migratory

and non-migratory subspecies differ in their seasonal fluctuations of body weight. More information is at hand for *merrilli*, a migratory race, than for others of like category. By combining the weight data for two closely related, resident subspecies with adjacent ranges, *actia* and *ammophila*, enough weights by the month are available so that a basis of comparison is afforded with *merrilli*. This action seems justifiable because the two races, *actia* and *ammophila*, are of similar size and poorly differentiated, differing but slightly in the color of the dorsum.

TABLE 2

BODY WEIGHTS OF MALE *merrilli* IN CERTAIN MONTHS

Month	*Number*	*Average*	*Minimum*	*Maximum*
June	9	27.8 grams	25.1 grams	31.8 grams
August	28	31.3 "	28.5 "	34.1 "
February	7	34.9 "	33.3 "	36.2 "

The data in Table 2 show that in the males of *merrilli* there is a pronounced increase in weight during the winter months. The yearly fluctuation, according to these data, is 7.1 grams, with the body weights averaging the heaviest in February. This is just before the spring migration which takes place in March. In the case of males of the resident races, the seasonal fluctuation is seemingly less pronounced, there being a yearly fluctuation of but 2.6 grams.

TABLE 3

BODY WEIGHTS OF MALE *actia* AND *ammophila*, COMBINED

Month	*Males*				*Females*			
	No.	*Av.* gr.	*Min.* gr.	*Max.* gr.	*No.*	*Av.* gr.	*Min.* gr.	*Max.* gr.
January	5	27.1	26.1	28.8	4	26.1	21.8	29.7
February	8	29.7	27.9	32.0	3	27.3	25.5	30.0
March	9	27.2	25.4	29.2	5	25.6	24.4	27.2
April	4	27.8	26.5	29.9	—	—	—	—
May	5	28.1	26.2	29.1	—	—	—	—
June	—	—	—	—	—	—	—	—
July	—	—	—	—	—	—	—	—
August	18	29.7	25.5	31.6	15	27.0	23.2	30.4
September	—	—	—	—	6	26.5	23.4	29.0
October	18	28.2	23.4	30.6	20	27.1	23.9	32.1
November	36	28.7	25.9	32.0	31	26.7	21.4	33.5
December	12	28.5	21.8	30.5	8	27.0	26.0	29.0

TABLE 4

SUMMARY OF BODY WEIGHTS OF MALES OF TWELVE SUBSPECIES OF THE HORNED LARK

	Spring and Summer					Autumn and Winter					Total				
	No.	*Av.*	*Min.*	*Max.*	*Range*	*No.*	*Av.*	*Min.*	*Max.*	*Range*	*No.*	*Av.*	*Min.*	*Max.*	*Range*
arcticola	23	35.9	33.0	42.0	9.0	4	41.9	38.9	44.6	5.7	27	36.8	33.0	44.6	11.6
merrilli	15	28.2	26.4	31.8	5.4	35	32.0	27.7	36.2	8.5	50	30.3	26.4	36.2	9.8
lamprochroma	29	28.7	24.0	32.5	8.5	49	30.4	25.0	35.2	10.2	78	29.8	24.0	35.2	11.2
utahensis	14	28.4	26.4	30.5	4.1	44	29.9	24.5	32.7	8.2	58	29.5	24.5	32.7	8.2
sierrae	—	—	—	—	—	1	31.0	31.0	31.0	—	1	31.0	31.0	31.0	—
strigata	1	30.0	30.0	30.0	—	—	—	—	—	—	1	30.0	30.0	30.0	—
insularis	—	—	—	—	—	17	31.7	29.8	35.0	5.2	17	31.7	29.8	35.0	5.2
rubea	14	28.8	26.5	33.4	6.9	51	29.9	24.2	35.7	11.5	65	29.7	24.2	35.7	11.5
actia	27	28.8	24.3	33.1	8.8	52	28.1	21.8	30.5	8.7	79	28.4	21.8	33.1	11.3
ammophila	10	28.1	26.2	30.0	3.8	33	29.5	26.7	32.0	5.3	43	29.2	26.2	32.0	5.8
leucansiptila	—	—	—	—	—	15	30.2	27.3	32.1	4.8	15	30.2	27.3	31.1	3.8
enertera	1	30.0	30.0	30.0	—	5	27.2	24.7	28.2	3.5	6	27.7	24.7	30.0	5.3

TABLE 5

SUMMARY OF BODY WEIGHTS OF FEMALES OF TWELVE SUBSPECIES OF THE HORNED LARK

	Spring and Summer					Autumn and Winter					Total				
	No.	*Av.*	*Min.*	*Max.*	*Range*	*No.*	*Av.*	*Min.*	*Max.*	*Range*	*No.*	*Av.*	*Min.*	*Max.*	*Range*
arcticola	10	36.8	30.0	42.9	12.9	1	44.9	44.9	44.9	—	11	37.6	30.0	44.9	14.9
merrilli	3	29.0	28.0	30.0	2.0	21	28.5	24.4	33.8	9.4	24	28.4	24.4	33.8	9.4
lamprochroma	23	27.6	24.9	31.5	6.6	24	27.3	23.0	31.3	8.3	47	27.4	23.0	31.5	8.5
utahensis	7	27.9	25.0	29.6	4.6	23	27.9	22.5	31.7	9.2	30	27.9	22.5	31.7	9.2
sierrae	1	26.0	26.0	26.0	—	1	31.3	31.3	31.3	—	2	28.6	26.0	31.3	5.3
strigata	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
insularis	—	—	—	—	—	8	29.9	28.6	31.5	2.9	8	29.9	28.6	31.5	2.9
rubea	8	27.2	25.2	28.9	3.7	32	27.8	22.8	32.9	10.1	40	27.7	22.8	32.9	10.1
actia	22	26.9	23.2	30.4	7.2	44	26.1	21.4	29.7	8.3	66	26.4	21.4	30.4	9.0
ammophila	3	26.8	25.3	27.7	2.4	10	27.6	26.0	30.0	4.0	13	26.7	25.3	32.0	6.7
leucansiptila	—	—	—	—	—	2	28.4	25.6	31.2	5.6	2	28.4	25.6	31.2	5.6
enertera	—	—	—	—	—	2	24.7	22.1	27.4	5.3	2	24.7	22.1	27.4	5.3

Thus it would seem that there is greater metabolic change and winter-fat accumulation in the case of migratory subspecies than in permanently resident ones. In the combined data of *actia* and *ammophila,* there are indications of two peaks throughout the year; one in August after the termination of the nesting season; the other in February.

SUMMARY

Differences in body weight between the two sexes have been shown. These are probably correlated with sexual differences in size. There are indications that the sexual differences in weight begin to be apparent in the juvenile stage. Juveniles weigh less than adults, but first year birds seem to weigh about the same as adults. Females, it seems, show less seasonal variation in body weights than do males.

In one race, *merrilli,* which shows migratory behavior, the seasonal fluctuations are pronounced in the males which weigh heaviest in February. In contrast, the combined weight data for males of two closely related resident subspecies with adjacent ranges show less pronounced seasonal fluctuation. A difference in physiology affecting weight between resident and non-resident races is thus suggested. In the case of the resident races there are indications of two peaks; namely, in August and February. Horned larks thus appear to show variation in body weight by reason of sex, age, geographic area and season.

Department of Biology
University of Utah
Salt Lake City, Utah

BIRD WEIGHTS AND EGG WEIGHTS

BY DEAN AMADON

IN 1922, Heinroth (18) published egg weights and body weights of several hundred species of birds of many orders from all parts of the world. With these data, aided by graphs, he was able to summarize the scattered observations of other ornithologists. Among the more important of Heinroth's conclusions are: (1)—large birds, in general, lay relatively smaller eggs than small birds; (2)—many groups have peculiarities of their own. Thus kiwis lay very large eggs, parasitic cuckoos very small ones, and precocial birds lay larger eggs than altricial ones of the same weight.

Julian Huxley (19) made a further analysis of Heinroth's data.

He realized that egg weight is not a simple linear function of body weight, but thought that it might be a non-linear function. If this were the case, the two might conform to the "Power Formula," which is expressed in general terms as $Y = bX^a$. The relationship expressed by this formula, as Huxley (20) has shown in his book, frequently exists between the size of an animal (X) and the size of one of its organs or parts (Y) when the two are changing or growing at different rates. When the formula applies, the ratio of the two rates of change remains constant and is equal to a. In the formula, b is another constant expressing the relative size of Y in terms of X. This formula, when written in logarithmic terms, becomes that for a straight line ($\log Y = \log b + a \log X$). Hence if the power law applies in any given case, the logarithms of the various corresponding values of X and Y, when graphed, will fall on a straight line.

Huxley found that egg and body weights in birds do tend to conform to the power formula. This is true both for groups of related birds such as families or orders and for birds in general when grouped into size classes. The logarithmic values of egg weight plotted against body weight for the various groups tend to fall on straight lines. The graphs for the various groups are usually almost parallel lines, whose distance apart is determined by variations in the constant b. However, most of the graphs show a tendency to flatten off somewhat as body weight increases. This would most naturally be attributed to a slight decrease in the value of the constant a, which determines the slope of the line. But the same flattening of the curves might be produced by including in one composite graph several sub-groups with different values of b but the same value of a. The graphs of some groups, for example the Anatidae, strongly suggest this possibility. Heinroth's data are not exact enough to permit an exact mathematical analysis of the problem. Huxley was unable to derive a mathematical expression of the relation between egg weight and body weight for this reason. But he gives an excellent discussion of the significance and possible biological explanation of this relationship, which should be considered in conjunction with the present paper. Huxley stressed the need for further investigations of this problem, based on more exact quantitative data.

The results of such a study form the basis of this paper. The subfamily Emberizinae of the sparrow family, Fringillidae, was selected, since body weights are available for several species. For comparison it was desired to include a distantly related group of non-Passerine birds. The American quail, which comprise the subfamily Odonto-

phorinae of the Phasianidae or pheasant family, were selected. The data available for this group are less exact and less extensive than those for the Emberizinae. This is reflected in the results given below.

If egg size is a function of body size, obviously an equation expressing this relation can be solved for either value. Hence, we can calculate the weight of a bird from the weight (or measurements) of its egg. This method of estimating bird weights may prove to be of considerable value in studying other problems. Eggs have been so extensively collected that museums contain the eggs of hundreds of species of birds of which no body weights have been recorded.

The usefulness of bird weights as a standard of comparison for variable appendages such as wing, tail, bill, etc., is not, I believe, sufficiently realized. By their use the general size factor can be eliminated when comparing the measurements of forms of different sizes. When the comparison is of linear measurements, the cube root of the weights can often be used to advantage as a standard of comparison. In work of this general nature, even an approximate, estimated weight will often give useful and valid results.

I am greatly indebted to Drs. Ernst Mayr and George G. Simpson of the American Museum of Natural History for numerous valuable suggestions. Professor F. B. Hutt of Cornell University gave me helpful advice. Miss Margaret Wythe and Dr. A. H. Miller kindly sent me the weights of some quail as recorded on the labels of specimens in the Museum of Vertebrate Zoology, University of California.

METHODS.—The weights of birds used in this paper, with one or two exceptions, have been taken from the literature from sources listed in bibliography "A". For most species only the weights of females were used. In a few, however, it was necessary to use weights taken from non-sexed birds. Since sexual size dimorphism in American sparrows and quail is always slight and often non-existent, it is believed no serious error is involved.

The eggs of but few species of wild birds have been weighed in sufficient numbers to give an average value exact enough for the present study. The loss of weight which occurs during incubation makes it necessary to weigh fresh eggs. This greatly limits the gathering of such data in the field. Fortunately, approximate egg weights can be estimated secondarily from the large collections of eggs, or more correctly egg shells, which exist. A possible method of doing this would be by direct displacement of water. This procedure would be laborious, difficult and rough treatment for the eggs. Heinroth filled egg shells with water and weighed them. This method has all of the

difficulties just mentioned, and is very likely to result in injury to the specimens. Bergtold (17) filled eggs with chloroform, which, he said, does not injure the shell. However, filling a small egg with fluid of specific gravity 1.5 must entail danger of breakage.

The third possible method of estimating an egg's volume or weight is from its measurements. Schoenwetter (21) proposed the formula: $W = \frac{1}{2}\ (LB^2 + w)$, in which W is weight of egg, L is length of egg, B is breadth of egg, and w is weight of the egg shell. In practice it was found that the egg shell in small Passeres is about 5% of the total egg weight. Hence Schoenwetter's formula may be reduced as follows: $W = .5\ (LB^2 + .05W)$ or $.5LB^2 + .025W$. Hence $.975W = .5LB^2$ and $W = .5128LB^2$. Bergtold (17) independently developed another formula: $W = 11/21\ (LB^2)\ S$. The symbols are the same; S is the specific gravity of a fresh egg, which Bergtold found to be 1.075 in hens' eggs and 1.043 in fourteen species of native (Colorado) birds. Using the latter value, Bergtold's formula reduces to: $W = .5463LB^2$. Worth (23) to get the volume of eggs used yet another method. He found by displacement that hens' eggs have about 15% less volume than an ellipsoid of the same length and breadth. Therefore, he used the formula for an ellipsoid less 15%, or $V = 1/6\pi\ LB^2 - 15\%$, which reduces to $W = .4749LB^2$. The formula $4/3\pi\ LB^2$, that of a prolate spheroid, has also been used. These formulas differ only because some have been more carefully corrected to apply to birds' eggs than others.

Two conclusions are immediately apparent from consideration of these formulas: (1)—in eggs of the same shape the volume is equal to LB^2 multiplied by a constant. The egg measurements are the only variables involved. It may well be the size (volume) of an egg that is of biological significance in relation to body size. But if the weight of the egg is considered the important factor, it is obtained by multiplying the volume by another constant, namely, the specific gravity. Probably the latter varies scarcely at all within a family of small Passerine birds, and perhaps not enough in the entire class Aves to affect the result of a study such as the present; (2)—if the size of birds' eggs (as expressed by volume or weight) is a mathematical function of the size of the birds, then LB^2 of the egg measurements is also a function of the size of the bird. For egg volume equals LB^2 times a constant, and the constant will cancel out in comparing different species.

For the purposes of the present study the volume or weight of eggs is not of interest *per se*. The value of the expression LB^2, which is based directly on the egg measurements, has been used without altera-

tion. This is to be preferred to the use of doubtfully accurate estimates of egg volume or weight derived by secondary manipulation of the expression LB^2. After the value of LB^2 has been computed from measurements taken to the nearest tenth of a millimeter, the result has been divided by 1000 to reduce it to the equivalent of cubic centimeters. It will be noted from the above formulas that such values of LB^2 are roughly twice the volume of the egg in cubic centimeters. Such direct use of LB^2, it should be emphasized, is valid only for comparisons of eggs of the same shape. This condition is usually met by members of the same family or even higher taxonomic category. Minor discrepancies resulting from variations in the shape of eggs of the same species will be eliminated in averages based on a considerable series of eggs.

The egg measurements used in this paper were taken to the nearest tenth of a millimeter with sliding calipers from specimens in the American Museum of Natural History. Bancroft (16) has described a device for measuring several eggs at one time. This would be of great utility, although not used for the present study. Average measurements of the eggs of many birds have been published. For computing the egg value or volume, unfortunately, such measurements cannot be used without inaccuracy, since the volume increases faster than the linear measurements. Perhaps this error would not be of importance unless a very exact value were needed. Eggs of different sets are likely to show a wider range of variation than those of the same set. Hence if all the available material is not measured, it is much better to measure an egg or two from each set than all the eggs of a few sets.

MATERIALS.—The following list gives the common and scientific names of the birds used in the present study. A note concerning the material from which the body weights and egg measurements were taken is given for each. For the eggs, the average value of the expression LB^2 (called "egg value" in this paper) is given. Unless otherwise mentioned, eggs were collected in the Middle Atlantic and New England states. For the Fringillidae the normal number per clutch, except where mentioned, is four to five eggs. The names marked with an asterisk indicate the species upon which the formulas given below are based. Numbers in parentheses refer to the appended bibliography.

FAMILY PHASIANIDAE, SUBFAMILY ODONTOPHORINAE

*NORTHERN BOB-WHITE, *Colinus v. virginianus*.—107 birds from Ohio and 4 from New England averaged 197.90 grams (1, 13). 76 eggs from eight sets from the northern states average 18.18. The eggs were collected from forty to seventy years

ago, before the introduction of smaller southern birds into the northeast. Probably the weights of the Ohio birds, at least, are of native northern stock also.

•TEXAS BOB-WHITE, *Colinus virginianus texanus*.—32 birds from Texas averaged 170.55 grams (11, p. 74). 64 eggs from 5 sets average 16.88.

•ARIZONA SCALED QUAIL, *Callipepla squamata pallida*.—141 birds from New Mexico averaged 197.9 grams (9). 23 eggs from three sets average 20.76.

•COAST CALIFORNIA QUAIL, *Lophortyx californica brunnescens*.—652 birds from San Mateo Co., California, averaged 189.5 grams (12, p. 249). 61 eggs from five sets average 20.25.

•CALIFORNIA QUAIL, *Lophortyx c. californica*.—29 birds from Los Angeles Co., Calif., averaged 159.3 grams (12, p. 249). However, study of Sumner's table of weights of this species suggests that this figure may be too low. This is also suggested by the results for this species given below. 72 eggs from seven sets from Los Angeles Co. and southern California average 17.93.

•MOUNTAIN QUAIL, *Oreortyx picta*.—Specimens in the Museum of Vertebrate Zoology averaged: 30 males, 234.57; 24 females, 230.62 grams. The latter figure is used in this paper. As Dr. A. H. Miller (in litt.) considers the geographical variation in this species not well worked out, these weights have not been divided according to localities. 45 eggs from 6 sets average 22.60.

•MEARNS'S QUAIL, *Cyrtonyx montezumae mearnsi*.—One male in the Museum of Vertebrate Zoology weighed 183.1 grams. 22 eggs from two sets average 19.01.

SUBFAMILY PERDICINAE

EUROPEAN PARTRIDGE, *Perdix perdix*.—46 birds from Michigan (introduced) averaged 379.88 grams (15, p. 12). 35 eggs from five sets from Washington state, England and Denmark average 26.32.

FAMILY CORVIDAE

EASTERN CROW, *Corvus b. brachyrhynchos*.—45 females wintering in Ohio averaged 491.1 grams, but some of these were (smaller) immatures (4). 10 eggs from as many sets average 37.951.

NORTHERN BLUE JAY, *Cyanocitta c. cristata*.—44 birds from New England averaged 89.22 grams (13). 10 eggs from 10 sets average 11.956.

FAMILY MIMIDAE

CATBIRD, *Dumetella carolinensis*.—11 birds from New England averaged 38.50 grams (13); 13 from Ohio 35.9 grams (7). 10 eggs from 10 sets average 7.341.

FAMILY FRINGILLIDAE, SUBFAMILY RICHMONDENINAE

EASTERN CARDINAL, *Richmondena c. cardinalis*.—141 birds from Ohio averaged 43.76 grams (1, 7, 10). 46 eggs from 15 sets average 8.617. Only three or four eggs per set.

SUBFAMILY CARDUELINAE

EASTERN PURPLE FINCH, *Carpodacus p. purpureus*.—148 females from New England averaged 24.60 grams (14). 29 eggs from 11 sets average 4.197.

EASTERN GOLDFINCH, *Spinus t. tristis*.—172 birds from Ohio averaged 13.41 grams (10). 18 eggs from 9 sets average 2.718. This species lays five or six eggs.

SUBFAMILY EMBERIZINAE

•RED-EYED TOWHEE, *Pipilo e. erythrophthalmus*.—58 females from Ohio and New England averaged 40.73 grams (1, 13). 76 eggs from 22 sets average 7.552.

•SAN FRANCISCO TOWHEE, *Pipilo maculatus falcifer*.—116 male weights averaged 39.03 grams (6). Assuming females to be 1.9% lighter, as they are in the Red-eyed Towhee (1), they would weigh 38.29 grams, which is the figure used. 46 eggs from 12 sets (California) average 7.388. Four, rarely three, eggs are laid per set.

•SLATE-COLORED JUNCO, *Junco h. hyemalis*.—171 birds from New England averaged 20.94 grams (13). 20 eggs from 20 sets (partly from southeastern Canada) average 4.469.

•EASTERN SAVANNAH SPARROW, *Passerculus sandwichensis savanna*.—82 birds from New England averaged 18.73 grams (13). 19 eggs from 5 sets average 4.019.

•NEVADA SAVANNAH SPARROW, *Passerculus sandwichensis nevadensis*.—9 birds averaged 16.25 grams (3). This is the average of the weights for the two sexes as given by Grinnell and is used because only weights of non-sexed birds are available for the Eastern Savannah Sparrow. In any case, the weight of *nevadensis* is very approximate, being based on only 9 birds. 38 eggs from 9 sets from the range of this race average 3.568.

•EASTERN VESPER SPARROW, *Pooecetes g. gramineus*.—38 birds from Ohio and New England averaged 24.14 grams (1, 13). 20 eggs from 19 sets average 5.018.

•EASTERN FIELD SPARROW, *Spizella p. pusilla*.—613 birds from Ohio averaged 12.7 grams (1). 21 eggs from 12 sets average 3.093.

•EASTERN CHIPPING SPARROW, *Spizella p. passerina*.—492 females averaged 12.0 grams (1). 51 eggs from 27 sets average 3.009.

TREE SPARROW, *Spizella arborea* subsp.—472 birds from Ohio averaged 19.53 grams (1). 24 eggs from 8 sets average 4.013. Of these, one set from Churchill, Manitoba, is of the eastern race, one from Alaska the western, and the others are from northern Mackenzie and may be either. The subspecies, however, seem to be based on differences of color and not of size. This species lays five or six eggs.

•WHITE-THROATED SPARROW, *Zonotrichia albicollis*.—93 females averaged 25.00 grams (7). 57 eggs from 14 sets (northeastern U. S. and southeastern Canada) average 5.379.

•EASTERN FOX SPARROW, *Passerella i. iliaca*.—34 birds from Ohio and New England averaged 38.24 grams (1, 13). 39 eggs from 12 sets from Quebec and New Brunswick average 7.102. Both this and the following race of Fox Sparrow lay only three or four eggs.

•MARIPOSA FOX SPARROW, *Passerella iliaca mariposae*.—150 birds averaged 31.44 grams (5, p. 314). 19 eggs from 6 sets from the range of this race average 6.415.

•EASTERN SONG SPARROW, *Melospiza m. melodia*.—267 females averaged 21.3 grams (8, p. 20). 98 eggs from 22 sets average 4.537.

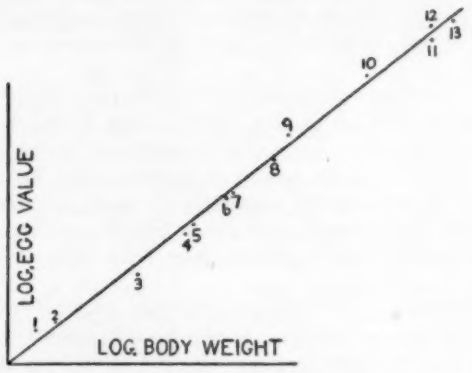
SWAMP SPARROW, *Melospiza georgiana*.—30 birds in immature plumage from New England averaged 17.61 grams (13). 9 eggs from 9 sets average 4.408.

•EASTERN LINCOLN'S SPARROW, *Melospiza l. lincolni*.—29 birds from Ohio averaged 19.24 grams (1, 7). 21 eggs from 5 sets from New Brunswick, Canada, average 4.134.

EASTERN SNOW BUNTING, *Plectrophenax n. nivalis*.—2 birds from Ohio average 33.75 grams (10); 6 from Long Island, New York, weighed to the nearest gram only, averaged 32 grams (personal data). 9 eggs from 9 sets from Greenland average 6.299. This species lays five, six, or even seven eggs.

NOTE.—It was originally planned to include the entire family Fringillidae in this

study. After some data had been collected, it became apparent that the Goldfinch and Purple Finch, which belong to the subfamily Carduelinae, lay relatively smaller eggs than the Emberizinae. Hence the study was further restricted to the subfamily Emberizinae, which includes most of our common sparrows. Text-figure 1 shows a logarithmic plotting of egg value against body size for thirteen forms of this subfamily. Eleven species and eight genera are represented.



TEXT-FIGURE 1—Numbered points on the graph represent the following species: 1, Eastern Chipping Sparrow; 2, Eastern Field Sparrow; 3, Nevada Savannah Sparrow; 4, Eastern Savannah Sparrow 5, Eastern Lincoln Sparrow; 6, Slate-colored Junco; 7, Eastern Song Sparrow; 8, Eastern Vesper Sparrow; 9, White-throated Sparrow; 10, Mariposa Fox Sparrow; 11, Eastern Fox Sparrow; 12, San Francisco Towhee; 13, Red-eyed Towhee.

All the points on the graph lie close to the 'line of best fit' plotted from the formula derived below. The deviations are so slight as to suggest that they may be due to the inevitable errors in the data. Of especial interest is the fact that although more than a threefold increase in weight is represented (from 12 to 40.73 grams), there is no suggestion of a relatively smaller egg size in the larger birds. Both b and a are constant in this group of species.

Having shown that the logarithmic graph of egg value against body weight is approximately a straight line in the species studied, it seems probable that the formula $Y = bX^a$ applies. It remains to calculate the values of the constants b and a from the data. This can be done by the method of least squares. The use of this method in zoölogical problems is illustrated by Simpson and Roe (22, p. 365). The data supplied by the thirteen forms of Emberizinae gives the formula: Body Weight $= 3.114\,(LB^2)^{1.265}$. To simplify the calculation of bird weights from egg measurements, the dependent variable (X) is here represented by LB^2, although the causal relationship would be better

shown by letting it be Y. However, despite similarities to the 'which came first' conundrum, probably all will admit that in the final analysis the size of the egg does not determine the size of the bird.

To learn how well this formula works, theoretical body weights can be computed for each species, using the egg values given above. The results are summarized in the following table:

Species	*Weight of Bird*	*Theoretical Weight Calculated from Egg Measurements*	*Error in Theoretical Weight*
Red-eyed Towhee	40.73 grams	40.19 grams	−1.3%
San Francisco Towhee	38.29	39.09	2.1%
Slate-colored Junco	20.94	20.70	−1.1%
Eastern Savannah Sparrow	18.73	18.52	−1.1%
Nevada Savannah Sparrow	16.25	15.57	−4.2%
Eastern Vesper Sparrow	24.14	23.96	−0.8%
Eastern Field Sparrow	12.7	12.70	0.0%
Eastern Chipping Sparrow	12.0	12.53	4.4%
White-throated Sparrow	25.0	26.16	4.6%
Eastern Fox Sparrow	38.24	37.19	−2.8%
Mariposa Fox Sparrow	31.44	32.69	4.0%
Eastern Song Sparrow	21.3	21.10	−0.9%
Eastern Lincoln's Sparrow	19.24	18.76	−2.5%

The calculated, theoretical weights given in the table are, without exception, remarkably close to the actual recorded weights. As would be expected, this is true of both species and subspecies. The eggs of the two races of Fox Sparrow, for example, are as different in size as they would be if the two were distinct species.

The two races of Fox Sparrow and the San Francisco Towhee lay only three or four eggs. It is of interest that their relative egg size is no larger than that of the other species, which all lay four or five eggs. In other groups of birds, variations in clutch size may be much greater, even among closely related forms. Undoubtedly such variations do have an effect on relative egg size, which it will be of interest to measure when the necessary data become available. Possibly a correction factor might be worked out to permit the same formula to be used for all members of a group, regardless of clutch size.

There is no reason to doubt that the above formula will give good results for other species of Emberizinae. Three for which inadequate data are available are as follows:

Species	*Weight*	*Theoretical Weight*
Tree Sparrow (two races)	19.53	18.06
Swamp Sparrow	17.61 (all immature)	20.34
Snow Bunting	32.44	31.95

As already noted, other subfamilies of Fringillidae seem to lay eggs of different relative size than do the Emberizinae. The results for three such species follow:

Species	*Weight*	*Theoretical Weight*
Cardinal (Richmondeninae)	43.76	47.50
Purple Finch (Carduelinae)	24.60	19.11
Goldfinch (Carduelinae)	13.41	11.03

Perhaps if a correction were made for clutch size in the Cardinal, which lays only three or four eggs, the theoretical weight would be closer to the recorded weights. The two finches lay relatively smaller eggs than the Emberizinae. Assuming that a is the same (1.265) for them as for the Emberizinae, the value of b can be computed for the Purple Finch; it is 4.008. If this value is inserted in the general formula, and the weight of the Goldfinch is estimated, the result is 14.20 (5.9% error). This is quite accurate, especially since the Goldfinch lays five or six eggs and may have a relatively small egg. Data for other species of Carduelinae are needed to improve this formula, and to determine if smaller relative egg size is a characteristic of this entire subfamily.

OTHER PASSERIFORMES.—Although the formula developed for the Emberizinae is unsatisfactory for some other subfamilies of Fringillidae, it gives a surprisingly good estimate for the Catbird, a member of a different family. The average weight of eleven Catbirds from New England was 38.50 grams; the theoretical weight based on eggs from the same region is 38.80 grams. Perhaps this is, so to speak, too good to be true. Nevertheless, it suggests that in some instances the same formula may apply to birds of different families. This can only be determined by trying it for several species of the groups in question.

For the Blue Jay and Crow, on the other hand, the Emberizinae formula predicts a weight far below (19% and 34%, respectively) the actual figure. If the value of b is calculated for the jay, again assuming a to be constant, and the weight of the Crow is predicted with the new value, the result is still much too low. Data for other

Corvidae will show whether this is caused by differences in the values of b or a, or both, for the two species.

PHASIANIDAE.—Calculating in the same manner from the data given above, a formula for the seven forms of Odontophorinae, or American quail, the result is: Body weight $= 10.386\ (LB^2)^{.982}$. This formula is based on poorer data than those available for the Fringillidae. Nevertheless, the errors in the theoretical weights calculated from this formula exceed ten per cent only once. This occurs in the California Quail, for which the weight used, as mentioned above, is probably too low. The weights are:

Species	*Weight*	*Theoretical Weight*
Northern Bob-white	197.90	179.4
Texas Bob-white	170.55	166.5
California Quail	159.3	176.6
Coast California Quail	189.5	199.0
Scaled Quail	197.9	204.1
Mountain Quail	230.62	221.9
Mearns's Quail	183.1	187.2

This formula is unsatisfactory for a member of one of the Old World subfamilies of the Phasianidae, namely, the European Partridge, *Perdix perdix*. This species weighs about 380 grams, the calculated weight is only 257.6 grams.

VARIATION IN a.—To facilitate discussion of variation in the values of a and b, these constants were recalculated, letting body weight be X, and egg value Y. The resulting formulas are:

Emberizinae: Egg value $= .413\ (\text{Weight})^{.786}$

Odontophorinae: Egg value $= .577\ (\text{Weight})^{.669}$

Although the value of a for the quail is based on rather inadequate data, it seems quite certain that its value in this group is less than in the Fringillidae. Until exact determinations of this constant have been made for other groups, it is unprofitable to discuss the possible significance of variation in a, except to refer to Huxley's remarks (19) on this point.

VARIATION IN b.—If egg weight were proportional to body weight, a would be unity, and the formula expressing this relationship would be: Egg weight $= b$ (Body Weight)^1. Here b is the simple ratio of egg weight divided by body weight. But in the present problem a is not unity, and the value of b is now equal to egg weight divided by the

body weight raised to a power. Hence the ratio of egg weight to body weight is not an index of true relative egg weight.

If the value of a were the same for the quail and sparrows, the respective values of b would be directly proportional to the relative egg sizes of the two groups. Since a is not the same, it is difficult to make a valid comparison of the relative egg sizes. By extrapolating from the formulas, however, the theoretical egg weights of birds assumed to be of the same weight can be calculated and compared. Such comparisons are of limited significance, because it is unlikely that the same formulas would apply over such a wide range in weight.

The average egg value of the thirteen sparrows listed in the above table is 5.053. The egg value of a quail assumed to be of the same weight as the average sparrow would be, from the formula, 4.909. The largest sparrow included in this study weighs about 40 grams, and the smallest quail about 160 grams. It is of interest to determine what egg values would be expected in birds assumed to be of intermediate size; *e. g.*, 100 grams. The respective theoretical egg values are: for the sparrow 15.42, for the quail 12.57. Finally, the egg value of a sparrow assumed to be of the same weight as the average quail can be compared with that of the average quail. The two values are: for the sparrow 25.51, for the quail 19.37.

In comparing these three pairs of values it is surprising to find that the eggs of the altricial sparrows are always larger than those of the precocial quail. Two possible reasons for this may be suggested: (1) clutch size in the quail is more than three times as large as in the sparrows, which would tend to increase the relative egg size of the latter; (2) the rate of decrease of egg size with increase of body size may be different (greater) in birds of quail size than it is in those of sparrow size. It will be interesting to compare the relative egg size of the sparrows with that of large birds which lay about the same number of eggs, such as herons, Cracidae, or shorebirds.

The difference in egg shape also tends to invalidate this comparison of relative egg size in sparrows and quail. An attempt was made to correct this error by the use of actual egg weights available for the Song Sparrow and Bob-white. The results seemed to indicate that error due to this factor is negligible, but this conclusion is based on such scanty data as to be of doubtful validity.

CONCLUSIONS.—(1) Egg size is a non-linear function of body size in birds. The relation between the two is expressed by the general formula $Y = bX^a$. (2) The constant a, which expresses the ratio of the rate at which egg size increases to that at which body size increases

from species to species, is shown to be constant (within the limitations of the data) for a subfamily of small birds having a weight range of from twelve to forty grams. There is considerable evidence that *a* has a somewhat smaller value in birds of large size, but more exact determinations are needed to calculate the extent of variation. (3) In the formula, *b* is a constant of proportion, which in this case reflects variations in relative egg size. Relative egg size is subject to great variation. Among the numerous factors affecting it are: body size, clutch number, condition of young at hatching, natural selection (parasitic cuckoos), or even artificial selection (Leghorn hen). Hence *b* is highly variable. However, in groups of closely related species, or groups in which the factors affecting relative egg size are similar, the value of *b* tends to be constant. (4) Since egg size is a function of body size, it is possible to calculate the size (weight) of a bird from the weight (or measurements) of its eggs. The variations in *a* and *b* make it impossible to use one formula for all birds, but a single formula will often serve for a group containing many species. In the only group studied with adequate data, weights calculated from egg measurements were accurate within 95%. This method of estimating the weights of birds is believed to be of considerable potential importance as an aid in other studies. (5) The relation between egg weight and body weight in other groups of birds should be investigated as rapidly as the necessary weights and egg measurements become available.

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American Museum of Natural History
New York City

A SYSTEMATIC STUDY OF THE MAIN ARTERIES IN THE REGION OF THE HEART, AVES VI. TROGONIFORMES, PART 1.

BY FRED H. GLENNY [1]

INTRODUCTION

IN several recent papers, the writer has presented the important features and arrangements of the main arteries in the neck and thorax of several families and orders of birds. In addition to the functional vessels of the adult, the writer has included notations on the persistence of certain vestiges of embryonic vessels.

During these studies, the writer has observed that within orders and even families of birds there is a certain constancy in the arrangement-pattern of the main arteries in the region of the neck and thorax of birds. In the present paper, the writer presents the basic arrangement-pattern of the arteries as found in several species of trogons.

Materials for this study were made available through the coöoperation of Dr. Alexander Wetmore, Assistant Secretary, Smithsonian Institution, and Dr. Herbert Friedmann, Curator, Division of Birds, United States National Museum.

MATERIALS

Single specimens of eight species of trogons were dissected and the arrangement of the arteries compared. Specimens of *Chrysotrogon caligatus* (Gould), *Priotelus temnurus* (Temminck), *Pyrotrogon erythrocephalus* (Gould), *Temnotrogon roseigaster* (Vieillot), *Curucujus* (*Trogon*) *massena* (Gould), *Trogon melanocephalus* Gould, *Trogon strigilatus* Linné, and *Trogonurus variegatus behni* (Gould) were included in this study.

The information thus obtained is set forth in the following observations.

OBSERVATIONS

The basic arrangement of the main arteries in the neck and thorax is essentially the same in each of the species studied.

The left and right innominate arteries arise from the aortic root and pass anteriorly and laterally to divide into the common carotid and subclavian arteries. The right systemic arch alone persists as the functional 4th aortic arch which joins the right radix aortae. The subclavian arteries each receive the coracoid major, axillary, inter-

[1] On active service with the Royal Canadian Army Medical Corps.

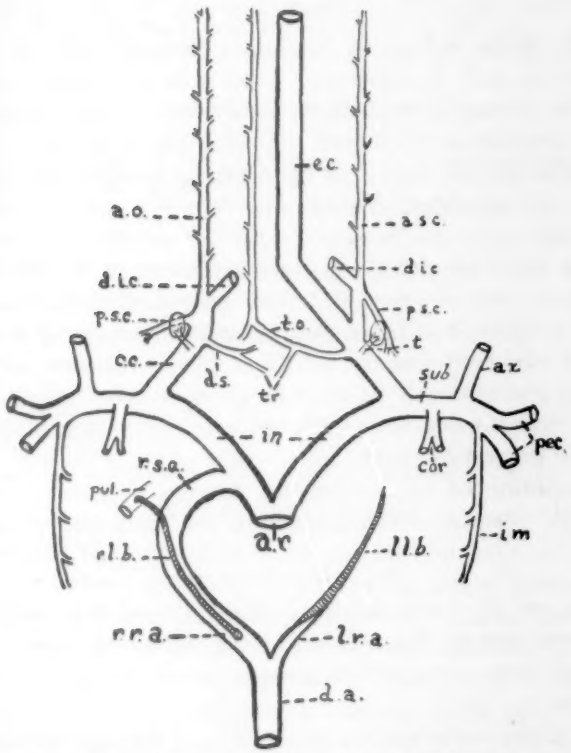
costal, and two pectoral arteries in order. The intercostal artery arises from the subclavian artery at the base of the posterior pectoral artery.

The left common carotid artery gives rise to the ductus shawi (a tracheo-oesophageal artery), thyroid, internal carotid, superficial cervical, and vertebral arteries. The ductus shawi sends off branches to the syrinx, trachea, and oesophagus anteriorly and to the oesophagus and accessory tissues posteriorly. The left internal carotid artery alone enters the hypapophysial canal and passes anteriorly along the median-ventral line of the neck. The superficial cervical artery gives rise to the vertebral and basi-cervical arteries before passing anteriorly to supply the musculature of the neck. The vertebral artery passes dorsally, in the region of the brachial plexus, and anteriorly. The basi-cervical artery passes posteriorly to the musculature of the shoulder. The thyroid artery arises at the point of bifurcation of the common carotid artery.

The right common carotid artery gives rise to the basi-cervical, thyroid, ascending-oesophageal, superficial cervical, vertebral, and ductus shawi arteries. The right basi-cervical artery supplies the musculature of the right shoulder. The right ductus shawi supplies the right side of the trachea and syrinx as well as the base of the oesophagus. The ascending-oesophageal artery is comparable to the left internal carotid and serves to supply the right face of the oesophagus as well as the muscles on the right side of the neck. The superficial cervical of the right side may or may not be present, but when present generally arises as a small branch of the ascending-oesophageal artery.

The left ligamentum aortae is present and entire in *Chrysotrogon caligatus, Priotelus temnurus, Pyrotrogon erythrocephalus,* and *Trogonurus variegatus behni;* and in *Temnotrogon roseigaster, Curucujus massena, Trogon melanocephalus,* and *Trogon strigilatus* the distal portion of the radix presents at least a short lumen while the anterior portion persists as the ligamentum aortae.

The right ligamentum botalli is minute and tends to fuse with the right radix aortae in *Chrysotrogon caligatus, Pyrotrogon erythrocephalus, Temnotrogon roseigaster, Curucujus massena,* and *Trogon strigilatus.* In *Trogonurus variegatus behni* the embryonic ductus arteriosus remains only as a small ligamentous 'button' and marks the distal attachment of the ductus to the right radix, while the ligamentum botalli is very prominent in *Trogon melanocephalus* and absent (probably entirely fused to the radix) in *Priotelus temnurus.*



TEXT-FIG. 1.—Diagrammatic representation of the main arteries in the neck and thorax of *Trogon melanocephalus*. Ventral view.

a.o., ascending-oesophageal artery.
a.r., aortic root.
a.s.c., superficial cervical artery.
ax, axillary artery.
c.c., common carotid artery.
cor, coracoid major artery.
d.a., dorsal aorta.
d.i.c., vertebral artery.
d.s., right ductus shawi.
e.c., internal carotid artery.
im, intercostal artery.
in, innominate artery.
l.l.b., left ligamentum botalli.
l.r.a, ligamentum aortae.
pec, pectoral arteries.
p.s.c., basi-cervical artery.
pul., pulmonary artery.
r.l.b., right ligamentum botalli.
r.r.a., right radix aortae.
r.s.a., right systemic (4th aortic) arch.
sub, subclavian artery.
t, thyroid artery.
t.o., left ductus shawi (tracheo-oesophageal artery).
tr, tracheal branches of ductus shawi.

DISCUSSION

From the above evidences, we may conclude that the species of trogons represented in this study show a characteristic relationship based on the arrangement-pattern of the main arteries in the neck and thorax. Variation in the degree of persistence of the left radix aortae and the right ductus botalli as ligamentous vestiges appears to be a specific or an individual matter and does not appear to have any generic value.

Although there are definite pattern-variations in the Coraciiformes, Anseriformes, Ciconiiformes, and other groups of birds, this is not the case in the trogons in so far as they could be represented in this study.

It may be observed that the left internal carotid artery alone enters the hypapophysial canal, whereas in some of the Coraciiformes, Anseriformes, Strigiformes, etc., both left and right internal carotids are present and enter the canal.

In the opinion of the writer, the trogons present a significantly characteristic pattern of the arteries in the neck and thorax region.

SUMMARY

1. Eight species of trogons were dissected and drawings of the arrangement-pattern of the arteries in the neck and thorax prepared.

2. A single basic arrangement-pattern was found to be characteristic for the family.

3. Only slight variations in persistence of the ligamentous vestiges of the left radix aortae and right ductus botalli were recorded.

4. The left internal carotid artery alone entered the hypapophysial canal.

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Bird Research Laboratory
Summit County Wildlife Research Station
Akron, Ohio

HEARING RANGES OF FOUR SPECIES OF BIRDS

BY ERNEST P. EDWARDS

IN continuing the experiments on the hearing of birds which the late Albert R. Brand and Prof. P. P. Kellogg began at Cornell University in 1938, observations have recently been made on the frequency range of hearing of four other species of wild birds in captivity. The apparatus used in the earlier experiments was placed at the author's disposal for the present experiments, and has made up a major part of the equipment used.

This series of experiments was begun in March, 1941, and is still in progress. The object of the work is to determine the frequency ranges of sounds to which different birds will respond. Observations have been completed on six captive individuals representing four species whose hearing ranges had not theretofore been investigated. These are as follows: one Canvas-back (*Nyroca valisineria*); one Great Horned Owl (*Bubo virginianus*); three Prairie Horned Larks (*Otocoris alpestris praticola*); one Snow Bunting (*Plectrophenax nivalis*).

An electric shock was used in teaching the birds to give a definite response when the sound stimulus was applied. Within one second after a pure tone was sounded close to the bird's cage, the bird was given an electric shock, and it soon learned that when the tone was sounded, a shock was imminent. Therefore, after a number of trials (usually 30 to 60) the bird began to respond to the sound as it did to the shock—by jumping or fluttering.

A beat-frequency oscillator was used to produce sounds with no overtones. Tones with frequencies from 20 to 17,000 vibrations per

second, or cycles per second, could be obtained from the oscillator. A small induction coil with movable secondary coil was used to control the force of the shock. The shock was applied through a bracelet around the bird's leg or through a specially wired cage floor.

In this sort of experiment it would be advantageous for us to be able precisely to control and measure the loudness level of the tones as they are received by the ear of the subject. However, only by intricate and tedious calculations can the loudness of a sound for any particular position of the subject be determined. Provided such a determination were made, even a slight movement on the part of the bird being tested would bring about a great enough change to render the determination valueless.

In view of the great difficulty of controlling the loudness at the ear of the subject, even under the most unnatural conditions, the author concerned himself only with maintaining the same loudness level at the loudspeaker for each bird tested. The distance from loudspeaker to cage was the same in each case, and the greatest volume obtainable from the apparatus was used as the limits of the range were closely approached. Thus all of the birds were tested under very nearly identical conditions.

The Canvas-back, a male, was caught in the wild and tested within a month of its capture. It responded to tones the frequencies of which were from 190 to 5200 cycles per second. Thus the lower limit was about half an octave below middle C, and the upper limit was a few notes above the highest note on the piano.

The Great Horned Owl, which was thought to be a female because of its large size, had been in captivity for only a few weeks before tests of its hearing range were completed. It responded to tones from 60 to 7000 cycles per second. This range extends more than an octave below the hearing range of any of the other birds tested in this investigation.

The three Horned Larks tested had almost the same frequency ranges among themselves. The arithmetical averages of their lower and upper limits were 350 and 7600 cycles per second respectively. Two females showed lower limits of 300 and 340 cycles per second and both were insensitive to tones above 7500. The male bird responded to sounds of frequencies between 420 and 8000 cycles per second.

The Snow Bunting, which was a male bird, was observed to respond to almost the same range of frequencies as did the male Horned Lark. In fact, the hearing ranges of these two individuals were more nearly

coincident than those of different sexes of the Horned Lark. The frequency range of hearing of the Snow Bunting was approximately 400 to 7200 cycles per second.

The range of frequencies which human beings normally are able to hear has usually been considered to be approximately from 20 to 17,000 cycles per second. Thus we see that man's hearing range is much more extensive than that of any birds thus far tested, especially in the lower frequency range. Similarly, other mammals which have been tested respond to a much wider range of frequencies than do these birds.

The results of these experiments as compared with the original investigations of Brand and Kellogg (1939 a, b) show an extension of the known range of bird hearing. The Great Horned Owl responded to tones of 60 cycles per second—more than an octave and a half below the former low of 200 for the Domestic Pigeon. The upper limit of 15,000 previously established for the Starling was not reached by any of the birds tested more recently.

SUMMARY

The approximate frequency ranges of hearing of the individuals tested are as follows:

1. Canvas-back—190 to 5200 c.p.s.
2. Great Horned Owl—60 to 7000 c.p.s.
3. Horned Lark (av.)—350 to 7600 c.p.s.
4. Snow Bunting—400 to 7200 c.p.s.

The frequency ranges of these birds are greatly exceeded in man, chimpanzee, monkey, dog, and cat.

These results extend the known hearing range of birds by more than one and one-half octaves at the lower end of the frequency scale.

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Laboratory of Ornithology
Cornell University
Ithaca, N. Y.

CRITICAL NOTES ON TWO SOUTHWESTERN SPARROWS

BY ALLAN R. PHILLIPS

CERTAIN of the Fringillidae are conspicuous examples of birds whose status in Arizona has changed with overgrazing of the region and consequent decrease of surface water and vegetation. The writer has given special attention to several of these species for the past few years, and these studies indicate that nomenclatural and taxonomic adjustments are desirable in two cases.

The authorities of the American Museum of Natural History, University of Arizona and Arizona State Museum, and especially the United States National Museum and the Fish and Wildlife Service, U. S. Dept. of the Interior, have greatly helped me in this study. I also wish to thank Dr. L. C. Sanford and Messrs. Lyndon L. Hargrave, Gale Monson, and Dwain W. Warner for the privilege of examining specimens in their private collections; Major E. A. Goldman for help in locating certain Mexican localities; Dr. Herbert Friedmann and Mr. Charles O'Brien for making certain critical American Museum specimens available in Washington; and Mr. J. Southgate Y. Hoyt for supplying data on the Botteri Sparrows in the Museum of Comparative Zoölogy at Harvard College.

BOTTERI'S SPARROW (*Aimophila botterii*)

All the large, pale, pointed-winged birds with restricted black markings occurring north of the range of *A. b. petenica* are currently referred to the nominate race. This may perhaps be attributed largely to the scarcity of the species in collections and the poor plumage of most specimens of this grass-haunting species. It still seems quite impossible to draw any really final conclusions, but enough specimens are available to demonstrate satisfactorily a part of the situation. Two new races may now be defined, the three currently recognizable ones being as follows:

Aimophila botterii texana, subsp. nov.

Type.—Adult male, U. S. National Museum no. 165,985, Biological Survey collection; Brownsville, Texas, May 2, 1900; collected by Vernon Bailey.

Subspecific characters.—Wing somewhat longer than in the other races of the species; gray areas of back and wings extended at the expense of the brown areas, and the latter a bit paler and perhaps redder, the colors being rather paler throughout. Culmen possibly a bit straighter.

Range.—Coastal prairies near the mouth of the Rio Grande in southeastern Texas and northeastern Tamaulipas. Winter home unknown.

Birds from southeastern Tamaulipas (Tampico) show some approach to *texana* in color and slightly longer wing, but specimens from farther inland (Mesa de la Angostura and Xicotencatl) seem to be good *botterii* except perhaps in bill size. The southernmost specimen which I would refer to *texana* is from the coast of Tamaulipas ten miles south of the Rio Grande.

Aimophila botterii goldmani, subsp. nov.

Type.—Adult male, U. S. National Museum no. 157,267, Biological Survey collection; Santiago, southern Nayarit, June 19, 1897; collected by E. W. Nelson and E. A. Goldman.

Subspecific characters.—Similar to *A. b. botterii,* but smaller, with more curved and usually shorter culmen; flanks darker buffy brown or gray-brown, and chest-band also darker. From the more remote *petenica* it differs primarily in paler upper parts with reduced black areas.

Birds from southern Nayarit are most typical, and differ from *botterii* further in the extension of the chestnut of the upper parts over the edgings of tertials and inner secondaries, greater wing-coverts, and upper tail-coverts.

Range.—Southern Sinaloa to southern Nayarit, at least. Winter home unknown, but perhaps resident where found.

All the specimens examined were taken by Nelson and Goldman in 1897. Localities are: Santiago (2 ♂, 1 ♀ June 19–21), Rosa Morada (2 ♂, June 22), and Acaponeta, Nayarit (1 ♂, June 29), and Rosario, Sinaloa (1 ♂, July 13).

It is perhaps surprising that the type of *mexicana,* taken in June, 1863, in the mountains of Colima, shows no approach whatever to the Nayarit race.

Aimophila botterii botterii (Sclater)

Zonotrichia botterii Sclater, Proc. Zool. Soc. London, 1857: 214 (near Orizaba, Vera Cruz).

Coturniculus mexicanus Lawrence, Ann. Lyc. Nat. Hist. New York, 8: 474, 1867 (mountains of Colima).

Peucaea aestivalis var. *arizonae* Ridgway, Amer. Naturalist, 7: 615, 1873 (Nogales, "Sonora").

This race is placed last because it is the most difficult to interpret. It may be expected to intergrade with all of the others. Skins from Palenque, Chiapas, are *petenica,* as has been previously recorded (Ridgway, U. S. Nat. Mus. Bull. 50, pt. 1: 260, 1901), while others from San Vicente (especially) and Ocozucuantla approach that race. Two March birds from San Bartolome are also rather dark, but this is perhaps due to the freshness of their plumage. Skins from the valley of Jiquipilas, Ocuilapa, and Tuxtla Gutierrez are *botterii,* though slightly smaller and darker than birds from Atlixco, Puebla,

and San Nicolas, valley of Mexico, which two localities are presumably representative of true *botterii*.

These reddish birds extend north in the east-coast district to southern Tamaulipas, as previously mentioned. Farther west, specimens from Colotlan, extreme northern Jalisco, and Plateado, Zacatecas, are badly worn but differ in having the culmen a bit more abruptly decurved at tip and the chestnut upper parts largely replaced by a gray and white pattern. Were they in better plumage, more satisfactory comparison could be made. A young female from Villar, San Luis Potosi, Sept. 23, is very dark, slaty gray on back and on bend of wing, with the browns not only reduced in extent but also dark and gray (less reddish); browns are evident only on nape and wings, but the post-juvenal molt is not yet complete. The buff and yellow tinges of typical *botterii* juveniles are practically absent. The remiges are edged externally with dark grayish brown instead of buff and tipped with small grayish, instead of conspicuous whitish, edges. This strikingly distinct bird probably represents the same race as the worn Colotlan adults. Skins from Guanajuato and "Eupátaro" approach this type, which should perhaps bear the name *Aimophila botterii mexicana,* although without more truly comparable material this point cannot be settled.

North of the above-mentioned localities, I know of no record whatever of any form of *botterii* for the north-central plateau, lying between the Sierra Madre Oriental and the Sierra Madre Occidental. To the west, however, some form occurs in southern Sonora (van Rossem, Trans. San Diego Soc. Nat. Hist., 6: 300, 1931; Guirocoba, May), and the species has long been known from the Arizona-Sonora border, from the Altar Valley (Stephens, Auk, 2: 226, 1885) eastward. The Arizona birds should probably be called *Aimophila botterii arizonae,* as they differ from true *botterii* in paler head and paler, duller chestnut backs. Juveniles differ from *botterii* in much the same way—paler above and on wing-coverts, broader pale feather-edgings (especially on crown and tertials), and often less yellow suffusion on the head.

It should be pointed out that the winter ranges of the various races remain to be worked out. Practically all the records fall between the beginning of May and early October. A specimen from Tampico in the American Museum of Natural History is dated "Mar., 1888," but its worn plumage indicates May as a more likely date of collection. Aside from this, I know of no March specimens from north of Cuernavaca, Morelos, where a female (Sanford coll.) was taken March 19,

1908, and three males (Sanford coll. and Am. Mus. Nat. Hist.) Apr. 6–27, 1908. Mr. Hoyt informs me that two females in the Museum of Comparative Zoölogy were taken at Chilpancingo, Guerrero, on Feb. 21 and Mar. 4, 1932. The earliest Chiapas birds in the Biological Survey collection are from San Bartolome, Mar. 24, 1904 (1 ♂, 1 ♀), and San Vicente, Apr. 16–20, 1904 (3 ♂). Since the bird appears to be such a late migrant, these March records probably indicate wintering localities.

The attached table of measurements shows that in *texana,* even in May birds whose tails are not badly worn, the wing is distinctly longer than the tail. While perhaps not quite so long, proportionately, as in *"Plagiospiza" superciliosa,* it still bridges fairly well the differences claimed by Ridgway (Auk, 15: 224, 1898). When the American Fringillidae receive a generic revision, I believe *superciliosa* will fall close to the *"Peucaea"* series.

COMPARATIVE MEASUREMENTS OF *Aimophila botterii*

	Wing	(av.)	Tail	(av.)
4 ♂ *texana*	65.3–68.2 mm.	(66.9)	61.6–66.0 mm.	(64.1)
3 ♀ *texana*	65.0 69.4	(67.2)	63.6–66.6	(65.2)
6 ♂ *goldmani*	59.3–61.6	(60.7)	59.5–62.8	(61.2)
1 ♀ *goldmani*	57.7		58.9	
5 ♂ *botterii* (Arizona)	60.5–65.8	(63.4)	62.1–67.8	(64.5)
1 ♀ *botterii* (Arizona)	64.6		67.5	
5 ♂ *botterii* (Puebla, June and July)	62.2–67.0	(64.3)	63.8- 71.3	(66.3)
3 ♂ *botterii* (Morelos, April)	63.1–64.2	(63.8)	63.7–64.8	(64.1)
1 ♀ *botterii* (Morelos, March)	62.6		65.0	
5 ♂ *botterii* (Chiapas, May and March)	61.2–62.0	(61.6)	62.7–65.8	(64.2)
1 ♀ *botterii* (Chiapas, March)	59.3		61.5	

SONG SPARROW (*Melospiza melodia*)

The Song Sparrows breeding from the central Rocky Mountains south to Sonora are currently supposed to belong to two races; a dark, northern *fallax* and a pale, southern *saltonis.* Both taxonomy and nomenclature, however, seem to need adjustment.

The oldest name available for any Song Sparrow of this region is *Zonotrichia fallax* Baird, 1854. This was based on a January bird from "Pueblo Creek" (now Walnut Creek), north of Prescott, Arizona. In 1884, Henshaw separated the Rocky Mountain race from that of Tucson, stating that "the type of *fallax* is from Tucson, and . . . represents the fall plumage of" the local breeding race. The name *fallax* was therefore applied to the desert race until Grinnell, in 1909, called the type "a migratory song sparrow, probably breeding in some part

of the elevated Great Basin tract to the northward"; he accordingly separated the birds of southeastern California.

The A. O. U. Committee on Nomenclature thereupon (see Allen, Auk, 26: 321–322, 1909) considered the case and refused to recognize *saltonis,* though admitting that "the type of *fallax* . . . proves not to be quite typical as to locality, being a winter specimen and a migrant." They considered that "there is not room nor good reason for admitting two forms of the pallid phase of the Song Sparrow," though "*saltonis* may perhaps be regarded as [its] extreme manifestation." Soon, however, Oberholser (Proc. Biol. Soc. Wash., 24: 252, 1911) and Grinnell (Univ. Calif. Publ. Zool., 12: 174, 1914) applied the name *fallax* to the Rocky Mountain race, and it is so applied today.

In 1929, Swarth (Proc. Calif. Acad. Sci., (4) 18: 328) pointed out that southeastern Arizona birds are darker than true *saltonis.* In 1931, van Rossem (Trans. San Diego Soc. Nat. Hist., 6: 302), while confirming Swarth's observation, considered the two populations not distinct enough for racial separation, remarking especially that a Hermosillo, Sonora, bird taken May 7, 1892, "is as pale as all but the very palest Colorado River *saltonis.*"

The present writer finds the differences pointed out by Swarth to be entirely constant when only fully comparable material in satisfactory plumage is compared. Specimens taken in May and later must often be identified arbitrarily by locality, but the genetic differences are hardly affected by this fact. I would recognize four races in the area in question, as follows:

Mountain Song Sparrow, **Melospiza melodia montana** Henshaw

Melospiza fasciata montana Henshaw, Auk, 1: 224, 1884 (Fort Bridger, Wyoming).

This race requires no discussion.

Canyon Song Sparrow, **Melospiza melodia fallax** (Baird)

Zonotrichia fallax Baird, Pr. Acad. Nat. Sci. Phila., 7: 119, 1854 ("Pueblo Creek" = Walnut Creek, north of Prescott, Arizona).

The type of *fallax* is a good match for specimens of supposed *saltonis* (Biological Survey coll.) from Pahranagat Valley, Nevada, and Beaverdam, Arizona (see Fisher, N. Am. Fauna, 7, p. 98–99, 1893). It agrees with the desert group of races in extension of reddish brown markings at the expense of black ones, but these browns are much darker than in the population found farther down the Colorado River.

This is a rare and restricted race. In addition to the type and the birds recorded by Fisher (*loc. cit.*), I have seen but one specimen that

I judge to be *fallax;* this is a juvenile male (Biological Survey coll.) from Supai [= Cataract] Canyon, Grand Canyon National Park, Arizona, June 21, 1929. It closely resembles juvenile *montana* but has paler, more reddish brown stripes and streaks on head, breast, and flanks. The specimens identified as *fallax* by Grinnell (1909) should be reëxamined; in view of Grinnell's subsequent action, they are probably *montana.*

The type of *fallax* may well have been resident where taken. It would seem strange if a random migrant should prove to represent such a small population, for there is little suitable Song Sparrow country in the apparent range of *fallax.* Many northern Arizona streams, now barren, probably flowed steadily and were bordered with brush in 1853. Kennerly's few notes on Walnut Creek indicate that it may have supported a resident Song Sparrow population; perhaps it still does, but this has not been proved.

Fallax seems a trifle larger than the more southern races. Two males measure: wing 68.8–69.5 mm., tail 70.–71.5. The type (sex ?) has the wing 68.8 and tail 72.7, by my measurements (*cf.* Grinnell, 1909).

Tucson Song Sparrow, **Melospiza melodia bendirei, subsp. nov.**

Type.—Immature male, no. 705, collection of A. R. Phillips; Salt River at Tempe Butte, Maricopa Co., Arizona, Nov. 11, 1941; collected by Lewis D. Yaeger, and prepared by Lyndon L. Hargrave (orig. no. H393).

Subspecific characters.—Similar to *M. m. saltonis* but darker, richer reddish brown on head stripes, breast and flank streaks, and tail and wing edgings and coverts. Thus intermediate between *fallax* and *saltonis* in color (but not in range).

Range.—Lower Sonoran Zone rivers of central and southeastern Arizona and northeastern Sonora.

I propose for this race the common name used in manuscripts by the late Herbert Brown. These birds are very constant in color in fresh plumage, and they occupy a distinct faunal area. Careful comparison of the Hermosillo specimen mentioned by van Rossem shows it to be actually a little *darker* than average *bendirei.* Farther west, specimens from Sonoyta, Sonora (near the Arizona border), are good *saltonis.* Farther north, two males (Biological Survey coll.) from Arlington, Arizona, are *bendirei,* but of these two the juvenile is paler than usual, being much like a juvenile *saltonis* from Needles, California. Intergradation may thus be expected a little south of Arlington, if any Song Sparrows breed along that part of the Gila River.

This race may appropriately be dedicated to Major Charles E. Bendire, whose valuable contributions to western ornithology began in southeastern Arizona.

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Desert Song Sparrow, Melospiza melodia saltonis Grinnell

Melospiza melodia saltonis Grinnell, Univ. Calif. Publ. Zool., 5: 268, 1909 (Salton Sea near Mecca, California).

This is the palest of all the "desert" Song Sparrows. It occurs as far west as the Salton Sea region of southeastern California and in northeastern Baja California (Hardy River at east base of Cocopah Mts.; Salton River at Seven Wells and at Gardner's Laguna). Along the Colorado River it ranges north at least to Needles, California, though specimens from that locality are darker and less rufescent. If Song Sparrows breed in the deep canyons of the Colorado River not far above Needles, they will probably prove intermediate between *saltonis* and *fallax*. It must be remembered, however, that Song Sparrows are very local in distribution in the inland southwest.

Farther east, a specimen (University of Arizona) from 4 miles west of Alamo, Yuma Co., Arizona, is paler than comparable *bendirei* and probably represents *saltonis*, though I have not yet made final comparisons. Two mid-July females (Biological Survey coll.) from the Big Sandy River at 2000 feet altitude, Mohave Co., Arizona, are perhaps also *saltonis* but are too worn for safe identification.

Since this paper was written, Marshall and Behle (Condor, 44: 122–124, 1942) have proposed a "new" race, *Melospiza melodia virginis*, from the Virgin River, Utah, and Pahranagat Valley, Nevada; this is, of course, a synonym of *M. m. fallax*, as defined above.[1] They produce evidence that *fallax* is a migratory race, though it is difficult to believe their implication that it does not winter north of "the southern tip of Clark County, Nevada." Exception must also be taken to their statement that Fairbank and Patagonia, Arizona, are points "where the ranges of these two races [*i. e.*, '*saltonis*' and '*fallax*' = *montana*] adjoin," since *montana* does not breed within more than 150 miles of either locality. This erroneous concept doubtless arose from Swarth's statement (*loc. cit.*) that "these two localities may be regarded as close to the eastern limit of the range of the subspecies *saltonis*." But *no* Song Sparrow is known to breed anywhere farther east at a similar latitude!

Cornell University
Ithaca, New York

[1] Marshall (Condor. 44: 233, Sept. 15, 1942) has already announced the identity of "*virginis*" with *fallax*.—ED.

NEW SPECIES OF BIRDS DESCRIBED FROM 1938 TO 1941

BY JOHN T. ZIMMER AND ERNST MAYR

W. MEISE prepared for the Eighth International Ornithological Congress at Oxford, 1934, a list of the new genera and species described between 1920 and 1934 (Proc. Eighth Int. Orn. Congr., Oxford: 90–189, 1938). He followed this four years later at the Ninth Congress at Rouen with a supplementary list of new species described since 1934. These lists have proven so useful that a similar list for the four-year period, 1938–1941, appears justifiable, even though there is no International Congress to be held this year. J. T. Zimmer is responsible for the discussion of the New World species and E. Mayr for the Old World forms. With one exception, a bird described in 1937 but omitted by Meise from his second list, the species here discussed were described between January 1, 1938, and December 31, 1941. Acknowledgements are made to Messrs. H. G. Diegnan, Rodolphe M. de Schauensee, Dillon Ripley, James P. Chapin, and Jean Delacour for information of service in the preparation of the report.

During this period, no less than 29 Old World and 24 New World species were described. It has been possible to examine only a very small number of the types, but the original descriptions, published plates, and sometimes additional information from the describers have served as the bases for the study. Doubt remains in some cases which can be dispelled only by examination of more adequate material, especially where the supposed new species were based on single specimens (possibly immature or aberrant) or where the taxonomy of the respective genera is still obscure.

Nevertheless, when all certain synonyms and subspecies are removed from the list, there remain some 13 Old World forms and 11 New World ones that are apparently valid species, an average of six per year. During the period of 1920 to 1934, about 150 good species were described, making about ten per year. The present figure is just over half the previous one but is higher than some more recent estimates (cf. Mayr, Proc. Linn. Soc. New York, 45–46: 19–23). The fact that most of the new birds come from islands, high mountains, or other isolated habitats, makes any new forecast difficult, but it is safe to say that practically all the widespread species of the birds of the world have been discovered, whether they be rare or common. There still remain a number of tropical islands, mountain ranges, or isolated peaks on which additional new species will undoubtedly be discovered.

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In the following list, it may be noted that four of the valid new species come from Africa, 8 from the Indo-Australian Islands, 2 from Mexico, and 9 from South America.

NEW WORLD SPECIES

TINAMIDAE:

Eudromia mira Brodkorb, Occ. Pap Mus. Zool., Univ. Mich., No. 382: 1, 1938.—120 kil. west of Puerto Pinasco, Paraguay
= *Eudromia mira*

This appears to be a good species with a restricted range, isolated from its congeners. Alignment with *E. elegans* is not impossible but there is considerable distinction and broad terrain to be crossed, over which there is as yet no indication of passage.

Nothura schreineri Miranda-Ribeiro, Rev. Mus. Paulista, 23: 700, 702, pl. 2, 1938.—"Minas and (Matto Grosso?) São Paulo?"
? = *N. maculosa* subsp.? or *N. boraquira*

The type of this form, presumably in the National Museum at Rio de Janeiro, has not been examined and it is difficult to place the bird with assurance from the description and figure. Hellmayr and Conover (Field Museum Nat. Hist., Zool. Ser., 13, pt. 1, No. 1: 95, 1942) think it is *boraquira,* but the photograph and description agree fairly closely with members of the *maculosa* group. The author's account of *"darwini"* in the same paper seems to have been compiled from other sources, not from specimens, and his remarks concerning comparison with that bird are thus unreliable, since his *"darwini"* may be something quite different. The lack of a definite locality for *schreineri* further complicates the problem. While *boraquira* is not known to occur in Minas Geraës, São Paulo, or Matto Grosso, the three suggested localities, some form of *maculosa* occurs in each of these states. There is grave doubt as to the existence of *schreineri* as a separate species.

ANATIDAE:

Amazonetta vittata Derscheid, Bull. Brit. Orn. Cl., 58: 60, 1938.—Argentine Republic, south of Buenos Aires
= *Anas brasiliensis*

The characters of this supposed form appear in birds from many parts of the range of *brasiliensis,* although we have not examined specimens from south of Buenos Aires. Mr. Jean Delacour informs us that Mr. Derscheid sent him a pair of his *"vittata"* which proved to be only examples of the dark extreme of *brasiliensis,* thus confirming our observations. Even if the characters should prove to be con-

stant in the birds from extreme southern parts of South America, a doubtful circumstance, the differences are not of specific value.

CRACIDAE:

Pauxi unicornis Bond and de Schauensee, Not. Nat., No. 29: 1, 1939.—Hills above Bolívar, near Palmar, Cochabamba, Bolivia
= *Pauxi pauxi unicornis*

It was, at first, a little doubtful whether *unicornis* were not a subspecies of *P. pauxi* of Venezuela, to which it undoubtedly has close affinity, but there remained a certain amount of distinction that needed to be overcome before formal specific union could be proposed. Material has since been examined that makes it evident that *unicornis* is of no more than subspecific rank.

TROGONIDAE:

Trogon rossi Lowe, Ibis, ser. 14, 3: 73, 1939.—patr. ign.
= *Trogon violacea*

The characters of *"rossi"* are amply covered by individual variants of *violaceus* from the northern part of South America.

PSITTACIDAE:

Pyrrhura chapmani Bond and de Schauensee, Proc. Acad. Nat. Sci. Phila., 92, 156. 1940.—La Plata, Huila, Colombia
= *Pyrrhura melanura chapmani*

The specific affinity of *chapmani* to the *melanura* group was suggested by the original authors who did not, however, make the formal assignment. There appears to be no doubt of the close relationship although the ranges of the different forms are not completely understood at present.

RAMPHASTIDAE:

Pteroglossus olallae Gyldenstolpe, Ark. Zool., 33 B, No. 12: 8, 1941.—João Pessôa, Rio Juruá, Brazil
= *Pteroglossus bitorquatus sturmii* × *P. flavirostris mariae*

The type is a curious bird with features belonging to both of the species mentioned, although in unique combination, and with occasional characters exactly intermediate, like the pectoral bar which is neither the black of *mariae* nor the red of *sturmii* but a dark maroon. The shape of the bill and its pattern show factors resembling first one and then the other. Count Gyldenstolpe records *mariae* from near the type locality of *"olallae"* while *sturmii* occurs at Teffé, on the upper Amazon, not far from the mouth of the Rio Juruá. The two species thus may easily meet on the Juruá and it is almost certain that *"olallae"* is the product of their hybridization.

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TROCHILIDAE:

Thalurania taczanowskii Dunajewski, Acta Ornith. Mus. Zool. Polonici, 2, No. 15: 322, 1938.—Achamal, Huambo Valley, Perú
= *Thalurania furcata taczanowskii*

This is a recognizable subspecies of *furcata* with a rather limited range as has been indicated also by Berlioz (Bull. Mus. Nat. Hist. Paris, 11: 287, 290, 1939).

Saucerottia florenceae van Rossem and Hachisuka, Trans. San Diego Soc. Nat. Hist., 8, No. 31: 408, 1938.—Rancho Santa Barbara, 20 mi. e. of Guiracoba, s.e. Sonora, Mexico
? = *Saucerottia (ocai) florenceae*

The original description of this bird, from a single female example, places it near the *sumichrasti-ocai* group but does not specify the characters that distinguish it from one or the other of those forms. In comparing the descriptions, however, a few differences appear, probably only subspecific. Until more is known of *florenceae*, it is impossible to place it in its proper niche.

APODIDAE: [MICROPODIDAE of the A. O. U. Check-List, 4th edition]:

Chaetura nubicola Brodkorb, Occ. Pap. Mus. Zool., Univ. Mich., No. 369: 1, 1938.—Mt. Ovando, Chiapas, Mexico
= *Chaetura rutila brunnitorques*

The description of this bird agrees so exactly in characters of size and coloration with the sooty extremes of *brunnitorques*, the most pronounced examples of which have no trace of rufous coloration, that identity is certain. Mr. Brodkorb has since written confirming this. *Brunnitorques* is a known inhabitant of the highlands of southern Mexico as it is over a wide range to the southward.

DENDROCOLAPTIDAE:

Dendrocincla taunayi Pinto, Bol. Biologico, n. s., 4: 190, 1939.—Tapera, Pernambuco, Brazil
= *Dendrocincla turdina taunayi*

From description and figure, *taunayi* appears to be a member of the *turdina* group, probably subspecifically distinct from the other known forms of the species.

FURNARIIDAE:

Cranioleuca solimonensis Pinto, Rev. Mus. Paulista, 23: 577, 1938.—Manacapurú, Amazonas, Brazil
= *Cranioleuca vulpina alopecias*

Described from a unique female, not certainly adult. The account agrees in detail with *alopecias* of which specimens are available from the same general area.

FORMICARIIDAE:

Pithys castanea Berlioz, Bull. Brit. Orn. Club, 58: 90, 1938.—Lower Pastaza, eastern Ecuador
= *Pithys castanea*

A very puzzling bird. In some respects its description suggests an abnormal individual of *P. albifrons brevibarba,* reported (as *albifrons*) by Berlioz from the same region, but there is too much disagreement in certain particulars to make this at all convincing. More knowledge of this bird is urgently needed.

Grallaria nattereri Pinto, Bol. Biologico, n. s., 3: 7, 1937.—Alto da Serra, São Paulo, Brazil
= *Grallaria nattereri*

There is a certain amount of resemblance to *G. ochroleuca* of Bahia and Ceará, but the differences seem to be of good specific value.

Grallaria auricularis Gyldenstolpe, Ark. Zool., 33 B, No. 13: 7, 1941.—Victoria, confluence of the Beni and Madre de Dios, Bolivia
= *Grallaria macularia auricularis*

The type of *auricularis,* examined, is distinguishable from *G. m. diversa* of the Amazon by characters of only subspecific value.

TYRANNIDAE:

Euscarthmornis aenigma Zimmer, Amer. Mus. Novit., No. 1066: 14, 1940.—Caxiricatuba, Rio Tapajoz, Brazil
= *Euscarthmornis aenigma*

We have not yet been able to connect this form with any other specific group.

Aechmolophus mexicanus Zimmer, Auk, 55: 664, 1938.—Cuernavaca, Mexico
= *Aechmolophus mexicanus*

No evidence is yet available showing association with other species. It was described from a single specimen but has since been augmented by an additional example as recorded subsequently (Zimmer, Auk, 56: 189, 1939).

Phylloscartes chapmani Gilliard, Amer. Mus. Novitates, No. 1071: 8, 1940.—Arabupú, Roraima, Venezuela
= *Phylloscartes chapmani*

Apparently a good species.

TROGLODYTIDAE:

Odontorchilus olallae Pinto, Bol. Biologico São Paulo, No. 5: 5, 1937.—Lago Grande, alto Rio Juruá, Amazonas, Brazil
= *Thryothorus griseus*

Obviously the same as *T. griseus* from the Rio Purus which has considerable resemblance to the genus *Odontorchilus* as pointed out

by Mr. Todd in the description of *griseus*. Subspecific distinction is possible although not very probable and only to be determined by a direct comparison of the two birds.

COMPSOTHLYPIDAE:

Basileuterus zimmeri Phelps and Gilliard, Amer. Mus. Novit., No. 1153: 11, 1941. —Queniquea, Táchira, Venezuela
= *Basileuterus zimmeri*

Although this form bears some resemblance to the *luteoviridis* group, the principal characters are rather abruptly defined and the range is divided by that of *luteoviridis*.

Dendroica potomac Haller, Cardinal, 5: 50, 1940.—Berkeley County, West Virginia
? = *Dendroica dominica* × *Compsothlypis americana*

This case is still subject to debate and more material must be available before certain conclusions can be reached. Much of the evidence, however, strongly points to a hybrid parentage, as indicated above.

COEREBIDAE:

Xenodacnis petersi Bond and de Schauensee, Not. Nat., 40: 1, 1939.—Yánac, Ancash, Perú
= *Xenodacnis petersi*

This form, together with its more recently described conspecies, *X. p. bella*, is not certainly conspecific with *X. parina* although of undoubtedly very close relationship. The difference in size is, however, the most pronounced feature, not suggested in the individual variations of *parina*. Perhaps when the wide extent of territory now standing between the respective ranges is exhaustively known, intermediacy may be found, but at present *petersi* may be considered as specifically distinct.

FAMILY ?:

Rhynchothraupis mesoleuca Berlioz, Bull. Brit. Orn. Club, 59: 102, 1939.—Juruena, Matto Grosso, Brazil
= *Rhynchothraupis mesoleuca*

Until the type of this form can be examined or additional material obtained, its status must remain problematical. We can find nothing to approach its described characters. The bill stout and conical, with the culmen nearly straight and produced on the forehead into a somewhat flattened mesorhinum, certainly suggests a troupial and not a tanager, and the long upper and under tail-coverts are not infrequent in the Icteridae. The small size (wing, 70 mm.; tail, 60) furnishes an argument against this assignment as does the white area of the breast and belly, although the glossy black upper parts might be Icterine. For the present, no definite assignment can be made.

ICTERIDAE:

Oreopsar bolivianus Sclater, Ibis, ser. 14, 3: 144, 1939.—Sucre, Bolivia
= *Oreopsar bolivianus*

An excellent species whose emergence from anonymity was surprisingly delayed since it is present in collections made many years ago.

OLD WORLD SPECIES

PHASIANIDAE:

Gennaeus moffitti Hachisuka, Bull. Brit. Orn. Club, 58: 91, 1938.—[imported from] "Calcutta"
= *Gennaeus leucomelanos moffitti*

This is, according to kind information from M. Delacour, a very distinct subspecies of *Gennaeus leucomelanos,* closest to *melanotus.* It is surprising that this distinct bird should have escaped the attention of the British sportsmen and naturalists. The true home of this race is still unknown, since it is only known from aviary specimens of unknown origin.

Houppifer hoogerwerfi Chasen, Treubia, 17: 184, 1939.—Atjeh, north Sumatra
= *H. inornatus hoogerwerfi* Chasen

A well marked North Sumatran representative of the south and central Sumatran *H. i. inornatus.* There is no evidence that *inornatus* and *hoogerwerfi* co-exist anywhere, nor are the differences sufficiently striking to be considered of specific value. The adult male of *hoogerwerfi* is still unknown.

COLUMBIDAE:

Treron pembaensis Pakenham, Bull. Brit. Orn. Club, 60: 94, 1940.—Pemba Island
= *T. australis pembaensis*

No character is given in the original description which would militate against considering this form a race of *Treron australis.*

TYTONIDAE:

Tyto nigrobrunnea Neumann, Bull. Brit. Orn. Club, 59: 89, 1939.—Taliaboe, Sula Islands
= *Tyto nigrobrunnea,* ? near *inexpectata* (Schlegel) (Celebes)

The classification of the barn owls of the *novaehollandiae* assemblage is still confused. Until more material is collected of this form (only a single female is known) and of other equally rare forms, it will be best to consider *nigrobrunnea* a separate species.

MOTACILLIDAE:

Anthus hoeschi Stresemann, Orn. Monatsber., 46: 151, 1938.—Erongo-Plateau, southwest Africa
= *Anthus hoeschi*

Size, emargination of wing, and color of tail indicate that this species is not conspecific with either *Anthus similis* or *richardi*, but nearer the latter. Known from two females. See also Hoesch and Niethammer (Jour. Ornith., 88 Sonderh.: 236, 1940).

TURDIDAE:

Alethe lowei Grant and Mackworth-Praed, Bull. Brit. Orn. Club, 61: 61, 1941.—Njombe, southern Tanganyika Territory
= *Cossypha anomala lowei*

The taxonomy of these thrushes is still unsettled in regard to the validity of genera as well as species. A complete revision is needed, based on more material than is available at present. *Alethe lowei* is undoubtedly not a full species, but whether *Cossypha anomala lowei* is the correct nomenclature, remains to be seen. Insular mountain range; known from a single female.

Sheppardia bensoni Kinnear, Bull. Brit. Orn. Club, 58: 138, 1938.—Chinteche District, western Nyasaland
= *Sheppardia gunningi bensoni*

Apparently a geographical representative of *gunningi*, together with *sokokensis* (see Macdonald, Ibis, ser. 14, 4: 663–671, 1940).

Turdus (*Geokichla*) *mendeni* Neumann, Bull. Brit. Orn. Club, 59: 47, 1939.—Peling Is., Celebes group
= *Geokichla erythronota mendeni*

This is a melanistic race of *erythronota* (Celebes), in which the white marks on wings and under parts have disappeared.

TIMALIIDAE:

Artisornis winifredae Moreau, Bull. Brit. Orn. Club, 58: 139, 1938.—Uluguru Mts., Tanganyika Territory
= *Mixornis* (?) *winifredae*

Apparently a good species, but known only from a single immature bird. It is not an *Artisornis*, but it seems premature to erect a new genus (*Scepomycter*) on such an insufficiently known form. Dr. Chapin tells us that the bird reminds him superficially of the genus *Mixornis*.

Crocias langbianis Gyldenstolpe, Ark. Zool., 31B, No. 3: 2, 1939.—Dalat, Langbian Plateau, S. Annam
= *Crocias langbianis*

A good species, related to *C. guttatus* (Java). A colored plate was published in L'Oiseau, 10: 75, 1940.

Elocincla aenigma Riley, Jour. Wash. Acad. Sci., 29: 39, 1939.—Klumpang Bay, southeastern Borneo
= ? *Malacocincla perspicillata*

The measurements published with the original description are misleading. The correct measurements are, according to information kindly given by Mr. Dillon Ripley: wing, type, 74 mm.; ♂ ad., 76.5; 2 ♀ ♀, 67, 72.5; tail, type, ♂, 38.5; ♀ 34.5; culmen, type, 16; ♂, 16; 2 ♀ ♀, 16, 16. The tail is, thus, longer than the tarsus and no reason whatsoever exists for a new genus. In fact, the specimens are extremely similar to *rufiventris*, differing merely as follows: "The crown is darker, more blackish, making a distinct contrast with the rest of the upper parts. The color of the upper tail-coverts is more rich and reddish. There is an indistinct loral stripe running up over the eyes. It is more grayish than in *rufiventris*. Below, the throat is white, the breast rather buffy brown with indistinct gray streaks running down from the lower throat onto the breast. The rest of the under parts are bright as in *rufiventris*" (Ripley *in litt.*). On the other hand the description of *aenigma* agrees exceedingly well with that of *M. perspicillata* Bonaparte, a species not represented in any American collection. The small discrepancies (lores not white, breast not plumbeous) are likely to be due to inaccuracies in the original description of *perspicillata*. *M. "aenigma"* seems fairly widely distributed in southeastern Borneo. The U. S. National Museum possesses specimens from the Kapuas River, Klumpang Bay, and Sungei Ritan (upper Belayan). The type of *perspicillata* was collected by Schwaner, probably on the Karau River, a tributary of the Barito River.

Malacocincla vanderbilti de Schauensee and Ripley, Proc. Acad. Nat. Sci. Phila., 91: 351, Pl. 20, 1939.—Atjeh, north Sumatra
= ? *Malacocincla vanderbilti*

Quite similar to *Malacocincla sepiaria tardinata* which occurs at the same locality at a lower altitude. Status undecided; either a montane species or an altitudinal subspecies. Known from only a single specimen.

Stachyris rodolphei Deignan, Field Mus. Nat. Hist., Zool. Ser., 24: 110, 1939.—Doi Chiengdao, northwestern Siam
= *Stachyris ruficeps rodolphei*

The babblers of the *ruficeps-davidi* group are still insufficiently understood and this is the reason why *rodolphei* was described as a full species. There are apparently two species involved, the ranges of which overlap in Indochina and on the Burma-Yunnan frontier, a situation comparable to that of *Alcippe nipalensis* and *morrisoniana*. It seems as if *praecognita, bhamoensis, bangsi, goodsoni* and *davidi*

belong to the species *davidi*, and all the other forms, including *rodolphei*, to *ruficeps*.

SYLVIIDAE:

Apalis argentea Moreau, Bull. Brit. Orn. Club, 61: 47, 1941.—Kungwe Mts., west. Tanganyika Territory
= *Apalis argentea*

A good species, with no close relatives. Known from a single male. Insular mountain range.

Sylvia ticehursti Meinertzhagen, Bull. Brit. Orn. Club, 59: 69, 1939.—Ouarzazate District, Moroccan Sahara
= ? immature *Sylvia deserticola*

The existence of a previously undiscovered localized species of *Sylvia* in the western Sahara is extremely unlikely. Only a single female known. Additional material will decide whether it is really a good species, or an aberrant immature of *deserticola*, or a race of *nana*, or if it belongs to another genus.

Tribura idonea Riley, Proc. Biol. Soc. Wash., 53: 48, 1940.—Dalat, South Annam, Indochina
= *Bradypterus luteoventris idoneus*

M. Delacour has shown (Ibis, 85: 35, 1943) that this is a race of *Bradypterus luteoventris*.

MUSCICAPIDAE:

Batis kathleenae White, Bull. Brit. Orn. Club, 61: 48, 1941.—Mwinilunga, N. Rhodesia
= *Batis margaritae* Boulton

Apparently synonymous with *B. margaritae* Boulton (1934) (Angola), which is not mentioned in the description of *kathleenae*.

Petroica archboldi Rand, Amer. Mus. Novit., No. 1072: 5, 1940.—Mt. Wilhelmina, 4100 m., Snow Mts., Dutch New Guinea
= *Petroica archboldi*

A very isolated species. It is perhaps remotely related to *P. rosea* and *rhodinogaster* from Australia. A series is available.

STURNIDAE:

Rhinopsar brunneicapillus Danis, Bull. Mus. Nat. Hist. Paris, 10: 46, 1938.—Buin, Bougainville, Solomon Is.
= *Rhinopsar brunneicapillus*

A very distinct species. The validity of the genus *Rhinopsar* needs to be re-examined in connection with a study of bill shape in the genus *Aplonis*.

CORVIDAE:

Zavattariornis stresemanni Moltoni, Orn. Monatsber., 46: 80, 1938.—Javello, Borana, southern Ethiopia
= *Zavattariornis stresemanni*

A very isolated species and genus, apparently without close relatives.

PARADISAEIDAE:

Astrapia mayeri Stonor, Bull. Brit. Orn. Club, 59: 57, 1939.—Mt. Champion, central New Guinea
= ? *Astrapia feminina* Neumann

Known only from the male. Since all *Astrapias* are geographical representatives, it is probable that this equals *Astrapia feminina* Neumann, which is known only from the female. Schraderberg, the type locality of *feminina*, is merely about 60 miles from the known range of *"mayeri."* The fact that the base of the tail is without white in females of *feminina* can not be considered a decisive objection against this interpretation since *"mayeri"* is intermediate between *splendidissima* and *stephaniae* in many respects, and it is quite possible that the females of *"mayeri"* are more similiar to *stephaniae* than the males. The case can not be decided until the female of *mayeri* or the male of *feminina* is collected at its respective type locality.

Taeniaparadisea macnicolli Kinghorn, Austr. Zool., 9: 295, 1939 (Dec.).—Highlands of central New Guinea, Hagen-Sepik district
= ? *Astrapia feminina* Neumann (1915)

See remarks under *Astrapia mayeri.*

PTILONORHYNCHIDAE:

Archboldia papuensis Rand, Amer. Mus. Novit., No. 1072: 9, 1940.—Bele River, 2200 m., Oranje Mts., New Guinea
= *Archboldia papuensis*

Good genus and species with no close relatives. Insular range; known from several specimens.

NECTARINIIDAE:

Cinnyris picta Hachisuka, Proc. Biol. Soc. Wash., 54: 52, 1941.—Atong-atong plantation, N. W. Basilan, Philippine Islands
= Freak or hybrid *C. j. jugularis* × *C. sp. juliae*

The circumstances of discovery make it very probable that *picta* is based on an aberrant specimen. The 'new species' is based on a single skin collected many years ago in a lowland coconut plantation on the well-collected island of Basilan. The combination of characters indicates a hybrid.

MELIPHAGIDAE:

Philemon brassi Rand, Amer. Mus. Novit., No. 1072: 13, 1940.—Bernhard Camp, Idenburg River, Dutch New Guinea
= *Philemon brassi*

An isolated species without close relatives. Known from a series from a single locality, but the range in the Mamberano basin is probably more extensive.

ZOSTEROPIDAE:

Zosterops chyuluensis van Someren, Jour. East Afr. Uganda Nat. Hist. Soc., 14: 114, 1939.—Chyulu Hills, Kenya, east Africa
= *Zosterops virens chyuluensis*

The African species of *Zosterops* are badly in need of revision. *Z. chyuluensis* is certainly not a separate species, but whether or not *virens* is the oldest name of the polytypic species to which it belongs, can not yet be decided.

Zosterops dehaani van Bemmel, Treubia, 17: 125, 1939.—Morotai, northern Moluccas
= *Zosterops atriceps dehaani*

Unquestionably a subspecies of *atriceps*. All the differences which van Bemmel lists between *dehaani* and *atriceps* are known to occur in the geographical variations of other species of *Zosterops*.

PLOCEIDAE:

Lonchura montana Junge, Nova Guinea, n. s., 3: 67, 1939.—Oranje Mts., Dutch New Guinea
= *Lonchura montana*, but superspecies *monticola*

Apparently a central New Guinea representative of *L. monticola* (southeast New Guinea), but the differences are so striking that specific rank is fully justified. Known from a good series.

Lonchura teerinki Rand, Amer. Mus. Novit., No. 1072: 14, 1940.—Bele River, Oranje Mts., Dutch New Guinea
= *Lonchura teerinki*

A good species, possibly related to *L. castaneothorax*. Known from a good series, but from only a single highland valley.

SUMMARY

The following 25 forms are recognized as good species or to be considered so in default of more exact information:

NEW WORLD.—
Aechmolophus mexicanus
Basileuterus zimmeri
Eudromia mira

Euscarthmornis aenigma
Grallaria nattereri
Oreopsar bolivianus
Phylloscartes chapmani
Pithys castanea
Rhynchothraupis mesoleuca (possibly belongs to Icteridae)
Saucerottia florenceae (? near *ocai*)
Xenodacnis petersi

OLD WORLD.—
Anthus hoeschi
Apalis argentea
Archboldia papuensis
Artisornis winifredae (*Mixornis*)
Crocias langbianis
Lonchura montana (superspecies *monticola*)
Lonchura teerinki
Malacocincla vanderbilti (? possibly altitudinal subspecies of *sepiaria*)
Petroica archboldi
Philemon brassi
Rhinopsar brunneicapillus
Tyto nigrobrunnea (near *inexpectata*)
Zavattariornis stresemanni

The following 15 forms are recognizably distinct but are of only subspecific rank:

NEW WORLD.—

Dendrocincla taunayi,	a subspecies of	*D. turdina*
Grallaria auricularis,		*G. macularia*
Pauxi unicornis,		*P. pauxi*
Pyrrhura chapmani,		*P. melanura*
Thalurania taczanowskii,		*T. furcata*

OLD WORLD.—

Alethe lowei,	a subspecies of	*Cossypha anomala*
Gennaeus moffitti,		*G. leucomelanos*
Houppifer hoogerwerfi,		*H. inornatus*
Sheppardia bensoni,		*S. gunningi*
Stachyris rodolphei,		*S. ruficeps*
Treron pembaensis,		*T. australis*
Tribura idonea,		*Bradypterus luteoventris*
Turdus mendeni,		*Geokichla erythronota*
Zosterops chyuluensis,		*Z. virens*
Zosterops dehaani,		*Z. atriceps*

The following 11 forms are certain or almost certain synonyms:

NEW WORLD.—

Amazonetta vittata	= *Anas brasiliensis*
Chaetura nubicola	= *C. rutila brunnitorques*

Cranioleuca solimonensis = *C. vulpina alopecias*
Nothura schreineri = ?*N. maculosa* (? *boraquira*)
Odontorchilus olallae = *Thryothorus griseus*
Trogon rossi = *T. violacea*

OLD WORLD.—
Astrapia mayeri = *A. feminina*
Batis kathleenae = *B. margaritae*
Elocincla aenigma = *Malacocincla perspicillata*
Sylvia ticehursti = ?*S. deserticola* (immature)
Taeniaparadisea mcnicolli = *Astrapia feminina*

These three birds are probably hybrids:

NEW WORLD.—
Dendroica potomac = ?*D. dominica albilora* × *Compsothlypis americana*
Pteroglossus olallae = *P. bitorquatus sturmii* × *P. flavirostris mariae*

OLD WORLD.—
Cinnyris picta = *C. j. jugularis* × *C. sperata juliae* (?may be a freak)

American Museum of Natural History
New York City

A NEW HORNED LARK FROM THE STATE OF WASHINGTON

BY STANLEY G. JEWETT

Otocoris alpestris alpina new subsp., ST. HELENS HORNED LARK

Type.—Adult male, No. 364,874, U. S. National Museum, Biological Survey collection; Arctic-Alpine Zone of Mt. St. Helens, Skamania County, Washington, June 10, 1941; Stanley G. Jewett, original number 1,016.

Subspecific characters.—Similar to *Otocoris alpestris arcticola* Oberholser (Proc. U. S. Nat. Mus., 24 (No. 1): 816, 1902) but smaller and more grayish (less brownish); dark centers of dorsal feathers appear darker and more blackish in contrast to the more grayish edgings; hind-neck, upper tail-coverts, and lesser wing-coverts brighter and more pinkish (less cinnamomeous), contrasting more sharply with the color of the back.

Measurements.—Male (seven breeding specimens from Mt. St. Helens, Washington): wing, 107–112 mm. (average, 109.7); tail, 66.5–72 (68.4); exposed culmen, 9.5–10.5 (10.2); tarsus, 22–23.3 (22.8); middle toe without claw, 12–13 (12.7). Female (seven breeding specimens from Mt. St. Helens, Washington): wing, 95.5–105 (100); tail, 57–66 (62.2);

exposed culmen, 9.3–10.3 (9.7); tarsus, 22–23 (22.5); middle toe without claw, 11–12.5 (11.8).

Geographic distribution.—Breeds in Arctic-Alpine biome of Mt. St. Helens and Mt. Rainier, Washington, and probably also on other high mountains in Washington, and possibly also farther north in British Columbia. Winters in surrounding lowlands.

Discussion.—One of the most interesting facts about this new horned lark is its greater resemblance to the white-throated *arcticola* of Alaska than to the geographically closer yellow-throated *merrilli* of the surrounding lowlands, a marked example of ecological segregation of races.

The breeding birds of Mt. Rainier are assumed to be this new race on the basis of a male and two females taken there in mid-August that have almost completely acquired their fresh autumn plumage. They are more grayish than similarly plumaged birds from Alaska, differing from them in the same way that breeding birds from Mt. St. Helens differ from Alaskan breeding specimens. In default of specimens it has been impossible to determine how far north the breeding range of this new race extends, but it is likely that it intergrades with *arcticola* somewhere in British Columbia, since migrant and winter specimens of the southern race have been seen from southern British Columbia. However, breeding birds from the mountains of northwest-central British Columbia (Stikine River and Iskut River) are *arcticola*.

Knowledge of the winter range of the Mt. St. Helens lark is at present very incomplete and is based on the following very scanty records: southern British Columbia (Okanagan, Dec. 2, and Corvallis, January); Washington (Kiona, Dec. 25; Moses Lake, Nov. 6–8; Edwall, March 20); and Oregon (Baker, Dec. 16, and Enterprise, Feb. 18).

The writer here wishes to acknowledge the assistance of Dr. John W. Aldrich of the Fish and Wildlife Service, Washington, D. C., in comparing and measuring specimens of horned larks during this study.

Portland, Oregon

GENERAL NOTES

Variation in the outermost greater primary covert as related to method of flight.—While engaged in a study of molts and plumages in the Galliformes, it was observed that, as compared with neighboring greater primary-coverts, the dimensions and strength of the outermost covert varied within the order so as to fall into four major types. In most grouse (Tetraonidae) and quails (Perdicidae), the outermost covert was found to be so greatly reduced as to be barely evident (type-1 covert). The larger pheasants (such as *Phasianus, Syrmaticus* and *Argusianus*), and the curassows, guans and chachalacas (Cracidae) possessed outer coverts of a small but easily visible size (type 2) while most guinea fowls (Numididae, except *Phasidus*) had outer coverts reduced in width only, being as long as adjoining coverts but quite slender and somewhat stiffened (type 3). The Peacock (*Pavo*), unique among the Phasianidae, the Hoatzin (*Opisthocomus*), and some megapodes (*Leipoa, Alectura* and *Aepypodius*) possessed full-sized (type 4) outer coverts. Of these types, numbers 2 and 3 were subject to some variation, as would be expected of intermediate classifications, and might possibly be broken down into several sub-types.

It seemed apparent that the size of the species was, if anything, only a secondary factor determining the outer-covert type. The larger grouse possessed relatively larger type-1 coverts, but the Hoatzin and the megapodes had type-4 coverts despite their medium size. A general inverse correlation between the size of the outer covert and the rapidity of wing beat seemed reasonable, however, and a cursory investigation of this phenomenon was attempted for other groups of birds.

The hawks (Falconiformes), hummingbirds (Trochilidae), and swifts (Micropodidae) were first examined in the expectation that these rapid flyers would possess small outer coverts. Most of the hawk species seen, however, possessed type-2 coverts and although the outer coverts of the soaring vultures (*Vultur, Gymnogyps, Cathartes*) were of the large, type-4 size, those of the Duck Hawk (*Falco*) were little reduced below those of other non-soaring members of the order. Turning to the hummingbirds where wing movement occurs at maximum speeds, it was determined that the outer primary-coverts were rudimentary (type 1) in several small genera (*Heliothrix, Anthoscenus, Calypte, Selasphorus*) and some large ones (*Topaza, Campylopterus*) but were somewhat larger (type 2) in a few of the bigger forms (*Eugenia, Bourcieria, Ensifera*). In contrast, several swifts (*Aëronautes, Chaetura, Cypsilurus*) possessed outer coverts of full length and only slightly diminished width. They were much stiffened, however, and were sharp-pointed and curved inward. They were assigned to type 3.

With some evidence to indicate that reduction in size or stiffening of the outermost covert was correlated with rapid wing motion in flight, it was thought that examination of the rails (Rallidae) as examples of birds of weak flight, would reveal their possession of type-4 coverts. Contrary to expectation, however, the outer coverts of *Rallus, Gallinula* and *Porphyrio* all proved to be of the rudimentary type-1 size. Whether the presence of this type of covert in the Rallidae can be interpreted as a vestige indicating more powerful flight at some remote time in the group's history is not certain. The cranes (*Grus*), also of the Gruiformes, had large type-4 coverts as did the Flamingo (*Phoenicopterus*) of the Ciconiiformes.

Among the Anseriformes, *Anas, Nyroca, Anser* and *Cygnus* possessed type-2 coverts as did such Passeriformes as the Cardinal (*Richmondena*), Catbird (*Dumetella*),

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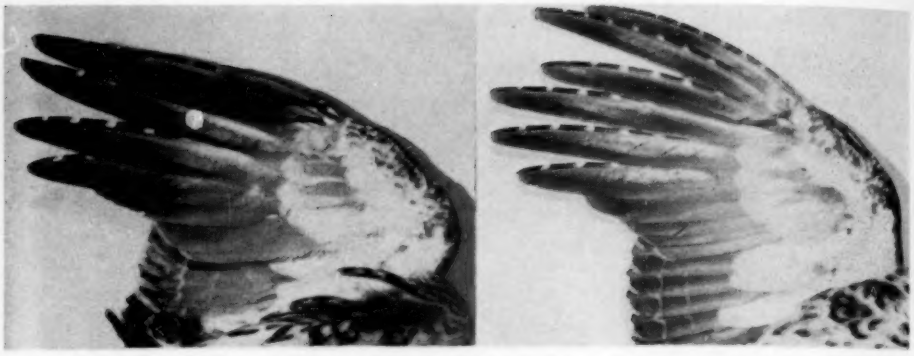
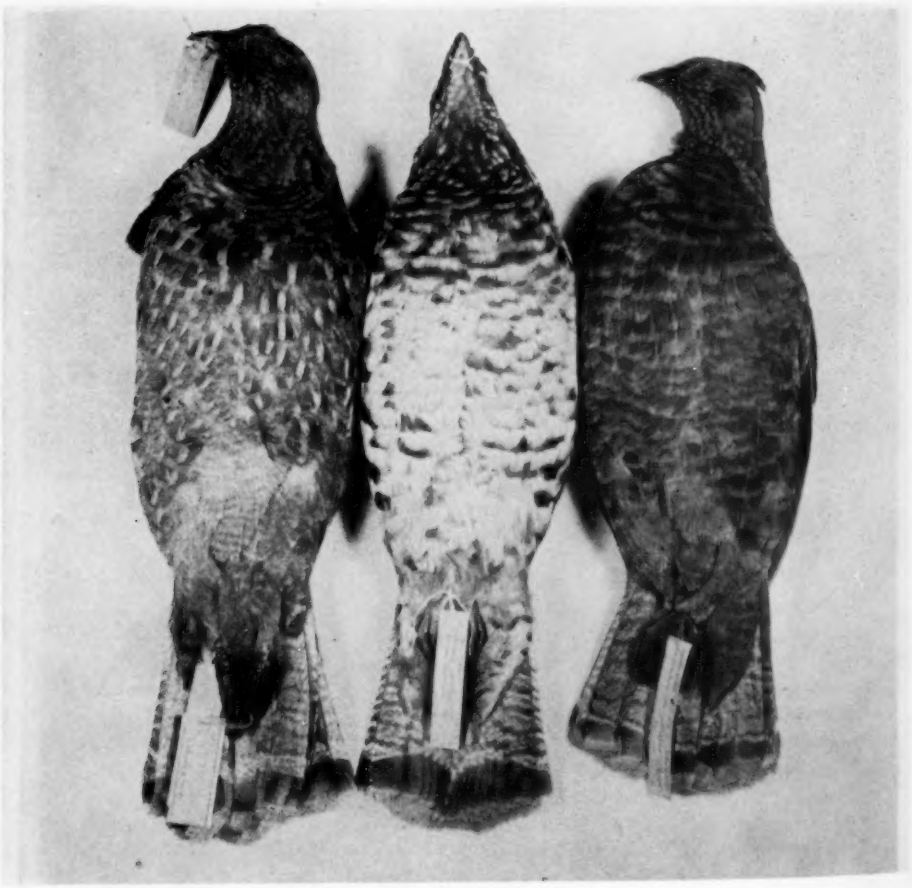


WRIGHT AND HIATT: OUTER PRIMARIES IN GALLINACEOUS BIRDS.
Sharp-tailed Grouse: (left) adult; (right) juvenile.



UTTALL: TWO ODDLY PLUMAGED RUFFED GROUSE. (Left, A. M. N. H., No. 45,176; (center) normal female; (right) A. M. N. H., No. 36,667.

Brown Creeper (*Certhia*), Yellow-billed Cuckoo (*Coccyzus*), Kingbird (*Tyrannus*) and Red-breasted Nuthatch (*Sitta*). Some of the smaller sparrows (*Pooecetes, Spizella*), warblers (*Dendroica*) and vireos (*Vireo*) had outer coverts that approached astonishingly close to type-1 size, though probably still in the type-2 category.

In species whose outer primaries were abortive, as in some tinamous (Tinamidae), woodpeckers (Picidae), kinglets (Sylviidae), and thrushes (Turdidae), the outermost primary-coverts were not evident and the coverts of the second outer primaries showed some of the modifications usually expressed by the outermost feather.

From these data, it was concluded that (1) although some evidence exists indicating that reduction in size or stiffening of the outermost covert is correlated with rapid wing motion in flight, at the present time it is not sufficient to permit a statement of general application; (2) most birds have type-2 outer coverts; (3) large birds of sedentary, sluggish or soaring habits and with slow wing motions characteristically possess large, full-sized type-4 outer coverts; and (4) variation in the size of the outermost covert may be of taxonomic significance.

The author is indebted to Doctors Alexander Wetmore and Herbert Friedmann of the United States National Museum and to Dr. John W. Aldrich of the United States Fish and Wildlife Service for making available the collections under their care.—George A. Petrides, *National Park Service, Washington, D. C.*

Outer primaries as age determiners in gallinaceous birds (Plate 7, upper figure).—Bent ('Life Histories of North American Gallinaceous Birds,' U. S. Nat. Mus., Bull. 146: 108, 125, 152, etc., 1932) points out that juvenile grouse do not shed the outer two pairs of primaries during the postjuvenal molt. Since these juvenal feathers are narrower and more pointed than those of the adult, it is possible to use this criterion in determining the age of grouse taken during the fall and winter months. Wight (Field and Laboratory Technic in Wildlife Management, Univ. of Mich. Press: 50, 1939), on the other hand, states that it is the adult bird which retains the outer primaries through the postnuptial molt rather than the juvenile.

Upon checking this character in Sharp-tailed, Ruffed, Franklin's and Richardson's Grouse in Montana against the presence or absence of the bursa of Fabricius, the writers find that Wight is in error while Bent is correct in stating that it is the juvenile birds which retain the outer primaries. Moreover, we have found that these grouse when taken in the latter part of September are completing the molt of the remiges. The accompanying figures illustrating the wings of adult and juvenile Sharp-tailed Grouse (*Pedioecetes phasianellus campestris*) taken on September 22, 1942, indicate that in the adult bird (Plate 7, upper left figure) the two outer primaries were growing in. The sheaths surrounding the bases of the growing feathers are clearly seen in the photograph. The juvenile bird (Plate 7, upper right figure), on the other hand, has the outer two remiges complete. The third primary from the outside was growing in, the sheath surrounding the base indicative. If the outer two primaries were to undergo a molt, they would have been shed earlier if the usual sequence of shedding of primaries was followed. Our experience with the above-mentioned species has indicated that when taken late in September, their age may usually be determined without difficulty by merely observing the state of growth of the outer primaries.

Wight states further that this character holds for all gallinaceous birds, and Bent (tom. cit.: 316) states that juvenile pheasants retain the outer primaries during the postjuvenal molt similar to grouse. That juvenile pheasants as well as adults

commonly molt the outer primaries during the postjuvenal and postnuptial molts, respectively, was recently observed by the writers. While employed by the Montana Fish and Game Department on Federal Aid Project 1-R, we had an opportunity to examine 1526 Ring-necked Pheasants (*Phasianus colchicus torquatus*) killed on September 26, 1942, near Billings, Montana, during a special season in which birds of both sexes were bagged. In the great majority of the birds, adults and juvenile cocks and hens, the outer remiges were undergoing a molt. Only a small minority of the juvenile birds had retained the outer one or two pairs of primaries. Most of the juvenile birds were readily distinguished from the adults by a weight difference or by traces of unmolted juvenal plumage. Because of the large number of birds to be examined in a brief period of time it was not possible to search each for the duct of the bursa of Fabricius.

We are anxious to record our findings in order that other investigators may not be misled by the statements of Wight and Bent that pheasants retain the outer primaries during the postjuvenal molt.—PHILIP L. WRIGHT, *Montana State University, Missoula,* and ROBERT W. HIATT, *Montana State College, Bozeman, Montana.*

Two oddly-plumaged Ruffed Grouse (Plate 7, lower figure).—While examining Ruffed Grouse (*Bonasa umbellus*) skins at the American Museum of Natural History, the writer encountered two extremely atypical specimens. Because these mutations are apparently undescribed and are so far outside the usual limits of variation in this extremely variable species, an account of them seems to be in order.

One of the birds, a male, (A. M. N. H. no. 45,176) was taken on Long Island, New York, in November, 1862, and originally belonged to George N. Lawrence. The other (A. M. N. H. no. 36,667) is from the collection of J. G. Bell, and bears no date, locality, nor sex. Its plumage is apparently that of a female. The diversity of this bird is recognized on its label by the word "variety"; that of no. 45,176, by the phrase "melanistic variety." Both birds have a distinctly abnormal brown cast. Most of this is probably basic, though some is perhaps due to the age of the specimens.

Dorsally, both birds are fairly normally patterned except for a reduction of whitish or ochraceous-buff (*B. u. umbellus* in mind). The ruff and subterminal tail-band of no. 45,176 are of a coppery-fuscous shade. The tail-band of no. 36,667 is more of a sepia color, while its ruff (only the right ruff is present), rather poorly developed, is made up of chocolate-brown feathers distally blotched with fuscous, with a subterminal, dark tan bar and a terminal, dark brown bar. Comparable areas in normal birds are usually of a gun-metal shade, though they will occasionally be brown. Such patterning in the ruff of the Ruffed Grouse is distinctly abnormal.

Ventrally, both birds present a decidedly atypical aspect, as is evident on the accompanying Plate 7, lower figure. The general color of the under parts is clay-brown. The pattern of the contour feathers is very different from the normal one, especially in no. 45,176 (Plate 7, lower left). Instead of the feathers being more or less basically whitish with brown-fuscous and buffy bars, as in the normal coloration, each feather of no. 45,176 has a subterminal, inwardly-pointing wedge of pale gray-buff. The rest of the feather is gray-brown in shade, and is crossed from its lateral edges to the gray-buff wedge with fuscous vermiculations. The total effect of these feathers gives the bird a streaked appearance ventrally, as is quite evident on the plate. Indeed, the belly of this bird superficially resembles the rump of a normal grouse. White is everywhere almost totally reduced, especially

on the abdomen and under tail-coverts. The under tail-coverts are basically olive-gray, terminally speckled with fuscous. The throat and face of this bird are reddish-brown where the area would be normally dirty white or buffy.

The cross-barring of the normal contour feather is partially preserved on the flanks of no. 36,667 (Plate 7, lower right), but the bars are considerably washed out in appearance. The lower breast feathers of this bird tend to be uniformly brown. A tannish longitudinal stripe runs with the midrib on each feather, much narrower than the comparably-located gray-buff wedges of no. 45,176. These stripes are bordered with fuscous areas. The abdomen, under tail-coverts, leg feathers, face, and throat are all lighter in shade than similar areas of no. 45,176.

These mutations illustrate extremes of variation that this highly variable species, and the *Tetraonidae* in general, can obtain. They can only be recorded, not explained, as the genetics of wild birds is still imperfectly understood.

Acknowledgement is due the American Museum of Natural History for permission to publish on these specimens.—LEONARD J. UTTAL, *Cornell University, Ithaca, New York.*

A peculiar Goshawk from Labrador.—The University of Michigan Museum of Zoology received from Ernest Doane a female Goshawk collected by him at Red Bay, Labrador, on November 11, 1925. I identified the specimen tentatively as *Accipiter gentilis gentilis* and recently sent it to Dr. Ernst Mayr for a more authoritative opinion and comparison with the good series of the European form in the American Museum of Natural History.

Dr. Mayr studied the specimen and wrote: "Your Goshawk is a curious bird. The feathers of the back show clearly that it is just completing its molt into the first adult plumage. This may explain the broad white margins on the lesser upper wing-coverts and the relatively heavy shaftstreaks on the under parts. Both these features are absent from nearly all our specimens of *gentilis*. Your bird is, as far as the underparts are concerned, fairly well matched by one Swedish bird. If we did not have this specimen, I might have written you that your bird is not *gentilis*. The bird is certainly not one of the eastern Asiatic races which are much more finely barred, and have very inconspicuous shaftstreaks. In many respects your bird looks almost like an intermediate between *gentilis* and *atricapillus*. I would very much like to see additional Goshawks from Labrador. The adults of *gentilis* are reported to be completely sedentary. Furthermore, the species does not occur on any of the North Atlantic islands. In fact, it is even a rarity on the British Islands, and does not nest there. Altogether you will agree with me that the situation is very puzzling. The date (November 11) agrees, of course, with the normal migratory period of the species. Concluding, I would say that the specimen can be recorded as a second year female of *Accipiter gentilis gentilis*, unless some day a subspecies is discovered in Labrador which is intermediate in character between the American and the European races."

In reply to Dr. Mayr's inquiry about additional specimens, I replied that we have in this museum another adult Goshawk, a male, taken at the same place six days earlier. However, this second bird is a perfectly normal example of *atricapillus*. This would seem to strengthen the case for considering the first specimen to be *A. g. gentilis*.

It is noteworthy that there are at least six records, mostly winter ones, of the American Goshawk being taken in England. On the other hand, the European

Goshawk seems to be much less migratory than the American form.—Josselyn Van Tyne, *University of Michigan Museum of Zoology, Ann Arbor, Michigan.*

A new swallow-shrike.—The material of the Whitney South Sea Expedition indicates that the New Hebrides and Banks Island are inhabited by an undescribed subspecies of *Artamus leucorhynchus*. It may be described as follows.

Artamus leucorhynchus tenuis, new subspecies

Type.—No. 214,076, Amer. Mus. Nat. Hist.; ♀ ad.; Gaua, Banks Is.; September 10, 1926; Whitney South Sea Expedition.

Diagnosis.—Similar to *Artamus l. melaleucus* (New Caledonia), but considerably smaller.—wing, ♂, 123.5–133 mm. (128.0); ♀, 122.5–131.0 (127.8); tail, ♂, 63.0–68.0 (65.7); ♀, 62.0–68.0 (65.4). In *melaleucus*, wing, ♂, 132.0–139.0 (135.1); ♀, 132.5–138.0 (135.3); tail, ♂, 68.0–73.0 (70.0); ♀, 66.0–71.5 (69.0).

Range.—New Hebrides (Efate, Leleppa, Mataso, Makura, Epi, Lopevi, Ambrym, Malekula, and Santo) and Banks Island (Gaua). Forty-five specimens examined.

A small series from the Loyalty Islands (Maré, Lifu) is somewhat intermediate, but is apparently closer to *melaleucus* (wing, ♂, 134.5; ♀, 130, 131, 132, 135, 135.5; tail, ♂, 68; ♀, 65.5, 66, 66, 68, 70). The smaller size and probable distinctness of the northern birds has already been discussed by Stresemann in his revision of the species (Novit. Zool., 20: 293, 1913).

That the lumping of specimens from the entire range of *tenuis* is justifiable is borne out by the statistics of the measurements of wing and tail. The standard deviations (δ) are: Wing, ♂, 2.28 ($n = 17$); ♀, 2.02 ($n = 22$); tail, ♂, 1.14 ($n = 19$); ♀, 1.41 ($n = 23$). The coefficients of variability (C. V.) are: Wing, ♂, 1.78; ♀, 1.58; tail, ♂, 1.73; ♀, 2.16. This variability is greater than we would find at a single locality, but not large enough to force us to call *tenuis* a collective race. Remarkable is the small C. V., considering the heterogeneity of the sample. Birds certainly show extremely little individual variability as compared to most other animals.—Ernst Mayr, *American Museum of Natural History.*

The name of the Sumatran Crested Olive Bulbul.—In a recent issue of 'The Auk' (59: 313, 1942), Deignan has shown that several genera of bulbuls should be united under the name *Microscelis*. He further designates *charlottae* as the specific name for the Malayan and East Indian bird formerly known as *Iole olivacea*. For the race from the Malay Peninsula and Sumatra there does not seem to be any name available unless *brunnescens* Finsch can be applied. However, this was a nomen nudum at its first appearance. Since then it has appeared only as a synonym (Sharpe, Cat. Bds. Brit. Mus., 6: 55, 1881) and consequently is unacceptable except as a synonym of *olivacea* Blyth [= *charlottae*].

Fortunately the United States National Museum possesses the type and unique specimen of *Iole olivacea crypta* Oberholser (Proc. Biol. Soc. Wash. 31: 197, 1918) from Djimaja Is. in the Anamba group. This specimen is a male collected September 22, 1899, by Dr. W. L. Abbott. It measures: wing, 92 mm.; tail, 80; culmen, 17. It is inseparable in color from September birds from Trang and Bandon, Peninsular Siam, and Sumatra.

The National Museum also possesses the type of *Iole olivacea perplexa* Riley (Journ. Wash. Acad. Sci., 29: 40, 1939). This and one other specimen mentioned in the original description were taken by H. C. Raven at Labuan Klambu, east

Borneo, June 28, 1913. Both birds are small with pale bills and pale margins to the wing-coverts and secondaries and are unmistakably immature specimens of *M. c. charlottae*.

Thus the Malaysian races of this species should be as follows:

1. *Microscelis charlottae crypta* (Oberholser)

Range: Malay Peninsula, Anamba Isls., North Natuna Is., Rhio Archipelago, Sumatra, Banka, Billiton, Tana Massa Is. (Batu Isls.).

2. *Microscelis charlottae charlottae* (Finsch)
[= *Iole olivacea perplexa* Riley]

Range: Borneo, Banguey Is.—S. DILLON RIPLEY, *U. S. National Museum, Washington, D. C.*

Chimney Swifts at play?—During the summer of 1937 at Grande Grève, Gaspé, Quebec, near the northern breeding limit of the species, I repeatedly witnessed what appeared distinctly as play behavior on the part of Chimney Swifts (*Chaetura pelagica*). Two pairs of these birds inhabited the vicinity, and were observed daily in their routine feeding flights above the fields and dooryards.

My dwelling stood upon a steep slope a hundred yards from the shore of Gaspé Bay and 150 feet above it. Favorite perch of many species of birds was a dead and barkless willow tree twenty feet high, whose many whitened branches were in plain view from the veranda, twenty-five feet away. All the finer twigs had been broken off, leaving few less than five millimeters in diameter. These branchlets were rather long and resilient with a general upward sweep at the ends.

My first observation of *Chaetura's* interest in this tree was on July 2, a bright calm day. Two swifts had been circling about together over the house and seaward slope. Suddenly one bird swooped noiselessly at the tree, veered slightly upward, and struck one of the branches an inch or so below the tip, bounding backward and upward. After completing a hundred-foot circle to seaward it repeated the performance, striking another branch. The second swift then joined the first, and for several minutes the pair continued circling and twig-striking. I could not see whether the birds struck with the feet or with the body near the feet; it definitely was not with the bill. Not once was a twig broken. Indeed, it was apparently not an attempt to obtain nesting material, for, without attacking any of the finer dead twigs in the dooryard, the birds soon swept off high above the lower slope in their feeding maneuvers. After circling about for a time over the fields, and even above the bay waters, but always visible through binoculars, they returned to the willow. One bird struck twice and the other once, then both resumed their aërial evolutions.

Throughout July and August, on a dozen occasions, swifts were seen thus playing at the willow. Usually only one or two birds took part, but twice I saw four associated. Although it is assumed that this group comprised the two pairs of adults known to have passed the summer at Grande Grève, the possibility exists that two of these birds were the offspring of the first pair seen performing on July 2. When three or four birds were thus engaged, their playful behavior was emphasized by their vocal exuberance while circling about between feats of twig-striking.

The behavior of a swift as it approached the tree consisted of (1) a direct glide at full speed, (2) a slight upward swerve toward the particular twig selected, (3) a barely visible braking motion of the wings as the bird assumed the upright position

for (4) the actual contact with the twig, and (5) an upward bound which, in most instances, was also somewhat backward. At times the act of striking seemed little more than a slight contact following a momentary hesitation. Such exceptional instances may be regarded as indicating the bird's reversion to true twig-breaking behavior, with recognition of the inappropriately large size of the branch as nest material.

One should consider the possibility that, instead of playing, these swifts were, in a rather desultory manner, displaying genuine nest-building activity. The breeding season is known to extend into late August on Cape Breton Island, where Dr. C. W. Townsend found half-grown young on August 22 (Macoun, Canada Dept. of Mines, Geological Survey Branch, Publication No. 973: 360, 1909). In Maine, Knight (Birds of Maine, 1908) reports egg-laying as late as July 10. So, as concerns the date, the twig-striking on July 2 might reasonably be regarded as an attempt to gather nest material. But several facts lead me to doubt this. First, these two pairs of swifts had been flying over Grande Grève daily since June 19. The same birds or others had also been seen half a mile distant over the forest in which I believe they nested. Never were they known to enter any of the few brick chimneys nor buildings in the village. Secondly, the yearly arrival of *Chaetura* in Gaspé as early as mid-June is attested by Demille (Auk, 43: 519, 1926) who observed twenty-five entering a hollow tree near Mont Louis on June 19, 1924. By July 2 such arrivals have probably finished nest-building. Thirdly, several recurrences of twig-striking through July and August almost certainly happened after completion of nests. Nevertheless, Dr. Townsend's record of August 22 nesting renders the date an unsafe criterion. I therefore, fourthly, fall back upon the circumstances as recorded above in deciding that these swifts were truly playing.

Finally, as an alternative, one may properly suggest that the sight of the conspicuous dead willow tree provided the stimulus which aroused the slumbering instinct to gather nest material (see F. H. Herrick, 'Wild Birds at Home': 151–153, 1935).—STANLEY C. BALL, *Peabody Museum of Natural History, New Haven, Connecticut.*

Bank Swallows nesting in artificial holes.—During the summer of 1942 I visited, a number of times, a colony of Bank Swallows (*Riparia riparia riparia*) that were nesting in drain holes in a concrete bank situated on the south shore of the St. Lawrence River opposite Montreal just above the town of Laprairie. The concrete bank, which is separated from the river's edge by a narrow strip of marsh and grass, is half a mile long and supports a roadway. The bank averages nine or ten feet in height and the holes are about four feet from the top of it. There are perhaps 100 of them, spaced evenly along the bank. They are about 4½ inches in diameter, inclining slightly upwards into the wall, and are lined with galvanized sheet metal. It did not appear as if water ever seeped through these holes. The colony consisted of about fifty pairs of Bank Swallows. There were also some twenty pairs of Tree Swallows (*Iridoprocne bicolor*) nesting in the holes, and on my first visit (May 21) a pair of Starlings were feeding young in one of them.

By July 2, all but one or two pairs of the Tree Swallows had left and the first of the young Bank Swallows were on the wing. On July 10, when Mr. and Mrs. L. M. Terrill and V. C. Wynne Edwards also visited the colony, several holes held fledged young, but on July 22, noticeably fewer adults were in evidence. On these last two dates, birds were seen carrying white (chicken?) feathers, the bird on

the 22nd taking the feather into a hole. On August 3, birds in still further reduced numbers were entering holes here and there along most of the length of the bank. By August 26, interest in the holes seemed to have disappeared, at least in mid-afternoon, although on this date there was a flock of about fifty Bank Swallows fluttering close to the bank, many of them settling on the top of the wall and some clinging to the concrete face.

The habit of this species of nesting in artificial holes in walls and banks has been noted in England infrequently from the time of Gilbert White (1774) onwards but appears to be unrecorded hitherto in North America.—P. A. D. Hollom, *Dorval, Montreal.*

Post-breeding pugnacity of the Pine Warbler.—On the Patuxent Research Refuge of the U. S. Fish and Wildlife Service, located near Bowie, Maryland, the Pine Warbler (*Dendroica pinus*) is a common summer resident. During the breeding season through May, June and July this species is restricted almost entirely to areas that have grown up to pitch pine (*Pinus rigida*) and scrub pine (*Pinus virginiana*). In late August and September, following the breeding season, these birds show a drastic change in habits and frequently occur in small flocks around the headquarters buildings. Here they generally may be found associating with Bluebirds (*Sialia sialis*) and Chipping Sparrows (*Spizella passerina*), feeding on the ground as well as in the bushes and trees of the orchards and landscaped areas. While watching these mixed flocks it was noticed that the Pine Warblers were extremely quarrelsome, frequently fighting among themselves, as well as giving chase to Bluebirds, Chipping Sparrows and, on one occasion, a Vesper Sparrow (*Pooecetes gramineus*). They were especially pugnacious toward the Bluebirds, for when one of these larger but slower-flying birds would leave its perch, it would often be assaulted by one and sometimes two Pine Warblers that darted after it, snapping their bills much in the manner of flycatchers chasing insects.—Robert E. Stewart, *Fish and Wildlife Service, Patuxent Research Refuge, Bowie, Maryland.*

Birds and smell.—Mr. P. A. Taverner's article on "The Sense of Smell in Birds" (Auk, 59: 462–463, July, 1942) evokes a responsive chord in me. I have a yellow-headed parrot as a pet, and this parrot frequently shares dinner with me; that is, he has a plate of his own alongside mine and enjoys the companionship and food allotted to him. He is particularly fond of steak and even more so of the long bones of chicken, which he will deftly open and from which he will extract the marrow. Most parrot owners are not aware of the carnivorous tendency of their pets. The amount of steak that he is capable of stoking away would do credit to a raptor of similar size.

The thing that has interested me more than the carnivorous habits of this bird has been his power of differentiating between various types of vegetables treated in a parallel manner, and which look similar after preparation. I have noticed that when these are placed before him he shows definite predilections. It is not the sight, apparently, that prompts him to give preference to this or that, but the olfactory sense. I have mixed these things partly and it has been very interesting to see with what precision he is capable of extracting the favored element. Although some of these things look very much alike, those that do not attract the bird cause him to stand aside a foot or more, but the moment that his favorite —particularly squash—comes to the table he shows a decided interest. I have therefore come to the conclusion that his power of selection is not visual as much as

it is olfactory. I might add that string beans, peas, and lettuce are also favorites of his, his main staff being sunflower seeds.

I have also been interested in the frequent use that he makes of bits of oak bark which he cuts from a slabside located in his cage. There is evidently something in that which fills a gap in his dietary complex.

A surprising thing about this parrot's feeding is the comparative infrequency of feeding. Passerine and gallinaceous birds are constantly in search of food, while this parrot feeds at rather distant intervals and in his dining-room performance enjoys a full gorge.—PAUL BARTSCH, *U. S. National Museum, Washington, D. C.*

The incubation period of the Great Horned Owl.—Bent (Life histories of North American birds of prey, Pt. 2, U. S. Nat. Mus. Bull. 170: 304, 1938) wrote of the Great Horned Owl (*Bubo v. virginianus*) that "the period of incubation has been estimated as from 26 to 30 days, but it does not seem to have been accurately determined; Professor Keyes (Condor, 13: 5–19, 1911) says that it is not less than 30 days, and probably more." This thought was reiterated by Baumgartner (Wilson Bull., 50: 274–285, 1938) after concluding his Ph.D. thesis research on the owl; he also cited correspondence with W. J. Breckenridge, who had "made some observations near Fridley, Minnesota, which indicate a period of at least twenty-nine days" (tom. cit.: 281).

In February, 1942, with advice and help of Dr. Paul L. Errington of Iowa State College, we undertook a study in the vicinity of Ames, Iowa. Among the known territories of the locally resident horned owls—doubtless *B. v. virginianus* (Swenk, Neb. Bird Rev., 5: 79–105, 1937)—one in particular seemed to promise a good opportunity to obtain data on the length of the incubation period. On Feb. 4, Dr. Errington, incidental to field work of a different nature, noticed that the owls were interested in a stick nest built the previous spring by a Red-tailed Hawk (*Buteo borealis*) in the crotch of a maple tree about forty feet above the ground; and, on the next occasion that the nest was observed, February 7, an owl could be seen sitting in it. The owl was not then disturbed, but, on the next day, it was flushed off the nest, and the single egg found there was marked.

The egg was suspected of having been laid on February 7, when the owl was first seen in the nest, but our main prospects of learning something definite concerning the incubation period depended, of course, upon whether another egg would be laid and hatched.

In view of the fact that incubation "normally begins with the laying of the first egg" (Baumgartner, tom. cit.: 281), the general procedure of our study was to examine the contents of the nest at daily intervals long enough to establish laying and hatching dates. Visits were planned for approximately the same hour each day (between 5:00 and 6:00 P. M., this being the only time that two of the authors could always be free to work together).

No change was observed on the visit of February 9, but on February 10 a second egg was found and marked. Thereafter, visiting was suspended to permit uninterrupted incubation and to reduce the chances of the eggs being abandoned or their embryos killed by chilling (see Baumgartner, tom. cit.: 281). It was felt that any advantages to be gained by marking possible additional eggs laid in the nest would be more than offset by greater risk to the clutch. Daily visits were resumed on March 4; on March 9, the first egg was found pipped, thirty days after the latest likely date of laying; and, on March 10, the owlet was hatched out but was still moist.

On March 12, the second egg had pipped, thirty days after marking; on March 13, the owlet had broken a hole in the shell about one-fourth inch in diameter; and, by the day following, March 14, this second young one was out of the egg and fully dry.

The weather from February 7 to March 14 was slightly warmer than usual. According to information given by the City Engineer of Ames, the average temperature over this period was 28.9° F.; the minimum, —5° (Feb. 18); the maximum, 64° (March 10). The temperatures recorded in Ames at 5:00 P. M. on the days that the eggs were exposed during our early visits were 30°, 26°, and 29°, Feb. 8–10, respectively, but we naturally took care to hurry out of the owl territory as soon as the necessary work at the nest had been done.—Arthur K. Gilkey, W. David Loomis, Bruce M. Breckenridge, and C. Howard Richardson, *Ames, Iowa.*

Raven eats Mormon cricket eggs—A juvenile specimen of the Western Raven (*Corvus corax sinuatus*) was collected in Vernon Creek, Tooele County, Utah, on August 5, 1941, as it rested upon a concrete livestock-watering trough. Examination of its stomach contents revealed the presence of three mature female Mormon crickets (*Anabrus simplex*) and 285 Mormon cricket eggs. Total insect food of three juvenile ravens and one adult, in addition to that listed above, consisted of five grasshoppers, seven beetles (three being weevils, *Ophryastes latirostris*) and one lepidopterous caterpillar. In addition, two stomachs contained hair and flesh of rodents, evidently of ground squirrels; one roundworm; 155 kernels of barley in two stomachs; and nine kernels of wheat in one stomach. Ravens often have been observed in numbers feeding in Utah areas in which there were Mormon cricket and grasshopper outbreaks during recent years.—G. F. Knowlton, *Utah Agricultural Experiment Station, Logan, Utah.*

Spring food of the Robin in central New York.—In a previous report [Wilson Bull. 52 (3): 179–182, 1940] I indicated the ease with which the food of certain passerine birds could be determined through fecal analyses and reported on the results of an examination of 700 Robin droppings taken during the summer at Ithaca, New York.

During May and June, 1942, several hundred Robin droppings were collected near my home at Ithaca, New York, and analyses of 200 of these droppings are recorded below. The droppings were collected at bird baths, on lawns frequented by these birds, and on sidewalks bordering barberry hedges which Robins frequented in some numbers. Direct observation substantiated the analyses which demonstrated that barberries were an important source of food during May and June, although insects were abundant and apparently secured with ease.

The following analyses were made of 200 Robin droppings collected between May 1 and June 12, 1942. The figures indicate the percentage of frequency of occurrence of the different food items.

Plants, 81.5: barberry, 61.0; sumach, 29.0; coral berry, 4.5.

Animals, 93.5: beetles, (chiefly *Aeolus mellilus* Say, *Brachyrhinus rugosostriatus* Goeze, and *Brachyrhinus ovatus* Linn.), 82.5; millipedes, 38.5; ants (chiefly *Lasius* sp.), 27.0; cutworms, 9.5; sowbugs, 6.5; wireworms, 4.0; flies, 3.0; cockroaches, 1.5.

It is interesting to note that the elaterids and curculionids, eaten in considerable numbers, are pests of considerable importance to man.—W. J. Hamilton, Jr., *Cornell University, Ithaca, New York.*

Duck Hawk eyries in southern states.—During a study of the breeding range of the Duck Hawk (*Falco peregrinus anatum*) in southern states, several findings were made which are worthy of record. On April 23, 1942, an eyrie was found in a gorge in northwestern Georgia. Although suspected as a breeding bird in Georgia (Eyles, 1936), this seems to be the first recorded nesting. Three eyases about four weeks old occupied a recessed ledge beneath an overhang on a cliff. The whole forest area had been recently burned out and smoke still hung in the ravines, yet the eyrie seemed to be unaffected by the conflagration.

Although the nesting of Duck Hawks in trees has been reported in Kansas and Illinois (Goss, 1878; Ridgway, 1889) and more recently in Tennessee (Ganier, 1932; Bellrose, 1937), apparently the nests were examined only from the ground. On April 20, 1942, a nesting site in northwestern Tennessee was rediscovered in an extensive swamp. The eyrie was the broken-off top of a giant dead cypress, seven feet in diameter at water level, and sixty feet high. Two eyas falcons, nearly four weeks old, occupied the floor of the open top, which resembled a huge cask half filled with decayed wood, feathers and bones. A small deciduous tree growing in the rubble furnished shade. While the eyases were being photographed and banded, the parent falcons protested with their familiar scolding cackle.

A second tree nest, also in a broken-top cypress, in a slough in northeastern Louisiana, was visited on May 11, 1942. This eyrie is considerably farther south than any hitherto reported in the eastern United States, and constitutes the first recorded nesting in Louisiana.

The writers are attempting to gather more information concerning the extent of a little-known tree-nesting Duck Hawk population along the Mississippi River system.—Richard Herbert and Roger T. Peterson, *New York City*, and Walter R. Spofford, *Vanderbilt University Medical School, Nashville, Tennessee.*

Duck Hawk at sea.—On December 15, 1938, en route to the United States from Chile aboard the Pacific Steam Navigation Company's liner 'Reina del Pacifico,' we were between Buenaventura, Colombia and the Panama Canal with the nearest land at least fifty miles to the east. When I went on deck about seven in the morning, the day was overcast and a strong head wind blowing. Everybody was watching a bird, a good-sized hawk, in the rigging. It was not difficult to identify it as a female Duck Hawk. I watched it for some time through the binocular when suddenly it flew away forward perhaps three or four hundred yards, keeping very close to the water and sometimes disappearing between the waves. It turned and came back, bringing in its talons a small sea bird, and alighting on one of the spars, it proceeded to devour its prey. It was impossible to identify the bird caught except to see that it was a small petrel. One of the sailors standing by remarked: "That makes four that she has caught this morning." Half an hour later, the hawk left the ship and did not return.

Migrating land birds frequently pause to rest on ships at sea that happen to be near their migrating route, and it is a daily occurrence to see them aboard during the migrating season. However, it was the first time I had ever seen a migrating bird-of-prey make a ship its headquarters while feeding on ocean birds. It is entirely possible that birds-of-prey that habitually feed on other birds may occasionally rest on ships while eating their victims. There is no reason why they should not do so, but I do not recall ever having seen it mentioned.—D. S. Bullock, *Angol, Chile.*

Status of *Dendroica cerulea* in eastern Maryland.—The centers of Baltimore and Washington are only about forty miles apart, yet the status of the Cerulean Warbler at these two stations seems to be quite different.

In 1922, Miss Cooke (Auk, 39: 570–572) listed all the known reliable records from the Washington region. There were seven records from Maryland and the District of Columbia and a few from adjacent Virginia. I am aware of but two published records from the region since that time: May 4, 1926 (Ball, Auk, 44: 259) and a male collected May 17, 1931 (Ball, Auk, 49: 362). When it is recalled that the District area has been under the constant scrutiny of some of our best field ornithologists for nearly a century, it becomes apparent that the Cerulean Warbler must be a distinctly rare bird in that region.

The Baltimore area, in contrast, was worked by a mere handful of men in the 'eighties and 'nineties of the last century and then lay fallow until about ten years ago, since when it has been worked somewhat by three or four men. Yet even rather desultory observation indicates that the Cerulean Warbler is of fairly regular occurrence in spring, as the following records show: one seen May 6, 1934, by H. C. Seibert; several seen May 12, 1934, by I. E. Hampe; two noted May 5, 1935, by Seibert; two May 16, 1937, by Kolb; one May 2, 1939, by Kolb (earliest date for both Baltimore and Washington); one May 5, 1940, by Kolb and Seibert; three May 7, 1940, by Seibert (one collected); one May 13, 1940, by Hampe; several records in 1941 and 1942 (see beyond).

East of its main, transalleghenian range this bird is known to breed locally. Three instances are known in eastern Maryland; each of the three localities is only about five miles from the other two. The first of these was reported by Pleasants (Auk, 10: 372, 1893) from Towson, Md., where a male was found singing on July 7, 1893, and two immatures and the adult male were collected the following week. The second was recounted at length by Kirkwood (Auk, 18: 137–142, 1901). He watched a singing male in Dulaney Valley throughout the summer of 1899, and the next year watched a pair and found their nest. Forty-one years later, on July 1, 1941, at Cromwell Bridge, I watched a male for three-quarters of an hour make successive feeding trips, collecting food from oaks along a railroad embankment and carrying it a short distance across a wooded ravine. Search through the heavy woodland failed to reveal the nest itself, but the behavior was so clear-cut that there can be but little doubt that breeding was in progress. During 1942 almost weekly trips were taken to this same region and, although many birds were noted throughout the season, the actual nest again eluded us.

However, the study during the past season has made the status of the birds here somewhat clearer. The first record was of two males, one collected on May 9. On May 23, a small bird foraging among the lower branches of a sycamore proved on collection to be a female Cerulean Warbler, the first of that sex we had noted. From May 30 until July 20, every visit to the area revealed one or more singing males. On the morning of June 24, at least five different males were singing along a half-mile stretch of river-bottom. The whole summer's observations brought the conclusion that this is a definite breeding population, not a sporadic occurrence of an isolated pair or two. That it is also a colony of long standing is suggested by the two records of nearly half a century ago, already cited.

The habitat studied is similar to that described as a favorite of the species in the Mississippi Valley, a dense, wet, river-bottom jungle dominated by sycamore (*Platanus*) and ash (*Fraxinus*), the higher branches of the former tree being the

especial niche of the Cerulean Warbler, except during migration. In the same niche, but generally ranging lower and more often visible, occurs the Parula Warbler (*Compsothlypis americana*). As has often been remarked, the songs of the two associated species are similar, but with a little practice it was found that they could easily be distinguished; this was established by repeated tests where the vocalist was later identified by sight. It was quite apparent that after migration only a person well acquainted with the songs of both birds would be likely to detect the presence of the former, for the Cerulean is seldom visible and never at all conspicuous.

Once the song was learned, checking on the birds was easy, for the males were persistent singers. One was noted to sing at intervals of one-half minute to two minutes for nearly an hour early one June morning. While most of the singing was done in the morning, good song was also heard on a hot afternoon when most other birds were silent. Nevertheless, singing rapidly decreased in July and the last heard was on July 20, after which the species was neither seen nor heard, though observation in the area continued until the middle of August. Apparently the fall migration is early. The latest date we have is August 19, 1900, the last time Kirkwood saw his birds.

Baltimore bird students have speculated considerably about several inconsistencies existing between the local avifaunas of Baltimore and Washington; the Cerulean Warbler is a major example. In spring we might suppose that our Ceruleans would come from the southwest, since the species belongs chiefly to the Mississippi Valley, and if they crossed the mountains as several such species are now known regularly to do, they might be expected to fan out northeastward across the relatively unobstructed piedmont or follow the northeast-trending ridges. It seems strange that some of the birds should, instead of such a course, adopt one due eastward; yet that is the only route by which they might avoid the Washington region, which lies immediately on our southwest flank, and where the species is apparently quite rare. This, as Dr. Lincoln has suggested (in litt.), may eventually be found to be the case. Cerulean Warblers are well known in western Maryland but we have at present only slight information from the intervening territory.

We do not know what significance our isolated breeding group has. It does not seem to be a pioneering community of a species extending its range, for it apparently has not spread over a period of many years, although there is much territory available which is seemingly as suitable as that which it now occupies. Nor does it seem to be a relict community, for we have found no evidence that the species was formerly any more abundant in the East than it now is. At present it seems to have no *raison d'être*, either ecological or historical.—Haven Kolb, *The Natural History Society of Maryland, Baltimore.*

Notes on the status of the Red Crossbill in Utah.—In his monograph on the Red Crossbill (Proc. Boston Soc. Nat. Hist., 41: 131–132, 1937) Griscom calls attention to the fact that relatively little is known regarding the status of this species in Utah, and that practically nothing is known relative to the breeding habits within the state. Woodbury (Condor, 41: 162, 1939) has more recently reviewed the literature on this subject and recorded some data from the University of Utah and Brigham Young University collections. Other scattered references to the species have been made within the past few years. In his recent paper on the birds of the Uinta Basin (Ann. Carnegie Mus., 28: 464–466, 1942), Twomey records seeing both

sexes feeding young that were two-thirds grown but makes no mention of finding any nests.

The writer's own experiences with the Red Crossbill go back to 1930 when he first began field work in the Uinta Mountains in northern Utah. Field work in later years, especially 1937 to 1941, indicates that this bird is a fairly consistent inhabitant of that mountain range.

In the summer of 1940, the breeding of Red Crossbills was definitely established at Lost Lake, western Uintas. The writer's attention was called to the nesting activity when on August 27 a female was noted on the ground pulling up the dried stems of *Vaccinium*. She soon flew to the nesting site which was on the limb of a tall Engelmann spruce about 40 feet from the ground. While she was working over the nest she was joined by the male; then both birds moved away out of sight. Assuming that the nest was under construction, and not wishing to disturb the birds, I left the area immediately. On August 30, the nest was visited for the second time and kept under observation for several hours. At that time it was a surprise to note that it contained at least three nearly full-fledged young. Apparently the female had merely been repairing the nest on the previous visit.

Both male and female participated in feeding the young at about half-hour intervals. The female came to the nest without apparent concern, but the male moved nervously about, uttering loud, sharp chirps while the feeding activity was going on. Unfortunately it was not possible to reach the nest with the equipment at hand, but some of the details of its construction could be made out from a steep hillside nearly on a level with it. The nest was composed mostly of dried *Vaccinium* stems which are very plentiful in that area. It was a rather bulky affair, plainly visible from below, and estimated at eight to ten inches in diameter.

On subsequent days, several families of streaked young out of the nest were seen in the same general vicinity. They were still being fed by the females; the males had gathered into small flocks and remained more or less by themselves.

The taxonomic status of Red Crossbills in the Uinta Mountains presents an interesting situation. A series of 22 specimens from the Brigham Young University collection was sent to Mr. Griscom who kindly determined them. All proved to be non-typical *benti*. According to Mr. Griscom the males of the series are of the non-rosy-red type like those of the western Colorado Rockies. Three birds from the Lost Lake and Trial Lake areas of the western Uintas show the bill characteristics of *bendirei*, which is the subspecies of western Wyoming, but are, nevertheless, referred to *benti*. This tends to confirm the mixing of eastern and northern faunas in the Uinta Mountains which is also evidenced by other animals, notably some of the mammals.

Twomey (*op. cit.*: 464) regards some of his specimens taken in the Uintas as approaching the more southern *grinnelli*. It seems possible, therefore, that the population from this range may present an odd mixture of the three surrounding races.

Collection and observation data on the Red Crossbill from the writer's notes may be summarized as follows: July 18, 1930, two immature birds collected from a flock (estimated as 50) near Trial Lake, western Uintas; July 24–30, 1937, fourteen specimens collected at Elk Park, eastern Uintas; August 24, 1938, three flocks observed in the vicinity of Trial Lake; various dates in June and July, 1940, many flocks observed at Lost Lake; August 27–30, 1940, six specimens, including the breeding male, collected at Lost Lake.

In many years of field experience the writer has not found the Red Crossbill in the Wasatch Mountains of Utah although there are scattered references to its occurrence there. Stanford (Proc. Utah Acad. Sci., 15: 144, 1938) records a specimen from Logan Canyon, Cache County. Mr. R. G. Bee records in his journal having seen three crossbills in the south fork of Provo Canyon, June 30, 1940.—C. Lynn Hayward, *Department of Zoology, Brigham Young University, Provo, Utah.*

Additional bird records for Grand Canyon National Park.—In 1937, there was published by the Grand Canyon Natural History Association a "Check-list of Birds of Grand Canyon National Park" (Grater, Natural History Bulletin, No. 8, 55 pp.). A study of this check-list indicates that 183 kinds of birds were then known from the area. For each kind, the seasonal status and, so far as known, the distribution within the park are given, and in cases of rare birds, record specimens are cited or details of the records are given. Although the subspecies for certain geographically variable types have not as yet been satisfactorily worked out, largely because of lack of specimens, nevertheless the list serves as a useful summary of all the data available up to the time of publication and so is a valuable working aid. Furthermore, since the avifauna of the Grand Canyon National Park typifies that of much of northern Arizona, it is to the interests of students of avian distribution that the list be kept up to date as new data accumulate. McKee (Condor, 41: 256, 1939) added four new species to the list. Arnold (Condor, 43: 292, 1941) added another. There are four additional records, thus bringing the list up to a total of 192 kinds.

Buffle-head, *Charitonetta albeola.*—A male specimen was found dead on November 21, 1940, on the bank of the Colorado River at the foot of Bright Angel Trail. It was turned in at the National Park Service Headquarters and prepared as a study skin, now number B-467 in the Grand Canyon National Park collection of birds.

Black Vulture, *Coragyps atratus atratus.*—On August 4, 1940, a Black Vulture was observed at Grandview Point which is about midway along the East Rim or Desert View Drive and at an elevation of 7496 feet. The lone bird was first seen about 4:00 p. m. at rest on an exposed promontory some 25 yards beyond and a bit below the rim proper. The black, seemingly featherless head and the contour of bill were distinctive. For several minutes the bird remained at its resting place and then, apparently disturbed by a crowd of people, took off with a wing beat that seemed a bit rapid for a vulture. In flight, the individual seemed smaller than its relative, the Turkey Vulture, which is common along the canyon rim. The ends of the primaries of the bird were not widely separated and the bird lacked the gray appearance beneath that one sees in the Turkey Vulture.

Incidentally, another person reported to the Park Naturalist that he had observed a Black Vulture at the same place and on the same afternoon. Very possibly this was the same bird; in any event the report served as corroborative evidence of the record noted here. Then at 10:15 a. m., September 10, 1930, a Black Vulture was again seen at Grandview Point, this time flying in company with Turkey Vultures. Thus the diagnostic features were again checked.

Taylor and Vorhies (Condor, 35: 205, 1933) summarized all records for the Black Vulture in Arizona up to April, 1933, and their observations suggest that in recent years the species has been appearing in increasing numbers in southern Arizona. The record of its occurrence nearest to the Grand Canyon region is from

the Tonto Basin. Black Vultures were seen there by Dr. A. K. Fisher in May, 1890 (see Cooke, Auk, 31: 403, 1914). The Tonto Basin lies in north-central Arizona, south of the Mogollon Plateau and roughly 120 miles south of the Grand Canyon. If the species is increasing in the state as Taylor and Vorhies surmise, the natural tendency would be for the birds to extend their range. Perhaps the individual observed at Grand Canyon represents a straggler on the outposts of the spreading population.

Taylor and Vorhies stated, too, that the bird's status is that of a regular winter visitant in the Lower Sonoran Zone of the state as far north as Tucson. The date of observation of the Grand Canyon individual suggests an interesting problem—whether the species may not ultimately become a summer resident at least, in some parts of the state.

SABINE'S GULL, *Xema sabini*.—On September 12, 1940, the writers noted a small gull flying along the edge of the canyon near the Yavapai Observation Station. After much hesitation the bird landed on the paved approach to the station where it remained for several minutes until frightened by an approaching car. It soon alighted again, however, and during the twenty minutes that it was under our observation, it was put to flight and came to rest several times. The bird was new to both of us, so notes were made concerning its appearance and a picture was taken of it. Later, the description of the bird, together with the picture, was sent to Miss Margaret W. Wythe at the Museum of Vertebrate Zoology, California. She has written that the bird was a Sabine's Gull. We are indebted to her for making the identification. This species has been known before to occur inland in this section of the country, for there is a late September record for the Great Salt Lake region based on a specimen taken near Ogden by Allen (Bull. Mus. Comp. Zoöl., 3: 173, 1872).

WATER-THRUSH, *Seiurus noveboracensis* [*S. n. limnaeus* McCabe and Miller].—A record not previously reported pertains to the finding of a Water-Thrush in the canyon. The specimen, a female, was found dead in the orchard at Phantom Ranch, 2500 feet elevation, by Mr. McKee on August 31, 1937. It was prepared as a study skin and is now No. B-258 in the Grand Canyon National Park collection of birds. On the day prior to the find, some people at the ranch asked Mr. McKee about the identity of a dark warbler-like bird, several of which had been seen along Bright Angel Creek. Later, seeing the 'pick-up,' they said it represented the birds they had seen. This suggests that a group of migrants was passing through at the time. Data that have accumulated from bird banding in the park indicate that many of the smaller birds in their trans-canyon migration movements gradually work their way down to the floor of the main canyon via side canyons, whereupon they likewise gradually work their way up the other side. This procedure, rather than a direct flight across the canyon, is indicated. Some types, of course, especially the larger birds, undoubtedly take the more direct route.

For the subspecific identification of the Water-Thrush, we are indebted to Dr. Alden H. Miller at the Museum of Vertebrate Zoology. Dr. Miller has written us that both in the very short wing length and in the dark tone of the back, this bird agrees closely with the race *limnaeus* which McCabe and he described (Condor, 35: 196, 1933).—WILLIAM H. BEHLE, *Department of Biology, University of Utah, Salt Lake City, Utah,* and EDWIN D. MCKEE, *Museum of Northern Arizona, Flagstaff, Arizona.*

Notes on two rare birds in Chiapas, Mexico.—In a former communication [Auk, 56 (4): 447–450, 1939], I reported the rediscovery of *Heleodytes chiapensis* (Salvin and Godman) and *Tangara cabanisi* (Sclater) in the state of Chiapas, southern Mexico. Both species had previously been known only from the unique types, taken many years before. Since my report, further collecting has shown the wren to occur at several localities in the Pacific lowlands of Chiapas, but no additional information on the tanager has been obtained.

During the course of recent field work in Chiapas, I had the good fortune to obtain the two additional rare species listed below. The trip on which one of these species was collected was supported by a grant from the Horace H. Rackham School of Graduate Studies of the University of Michigan.

Xenotriccus callizonus Dwight and Griscom

Xenotriccus callizonus Dwight and Griscom, Amer. Mus. Novit., 254: 2, March 8, 1927 (Panajachel, Lake Atitlán, Guatemala).

This remarkable flycatcher was described from a male and an immature bird collected during the autumn of 1926. Another immature specimen was obtained at the type locality in August, 1930, and a fourth bird shot was inadvertently destroyed. I secured two specimens at Chichimá, Chiapas, on March 29 and April 1, 1941. Chichimá, which has an elevation of about 1700 meters, is a *ranchería* situated in a large sink hole on the barren limestone plains two miles southeast of Comitán. The birds were found in a grove of trees along a ditch. The male was collected first. The light in the grove was so poor that his markings could not be made out, but from the bird's behavior and its long crest I realized at once that it was something which I had never before collected. Unfortunately I had to shoot it with a large-bore gun, and the specimen was rather damaged. The female was seen in the same grove three days later. Although restless, like most small flycatchers, she allowed me to approach close enough to kill her with a .22-calibre collecting pistol. The only sound I heard either bird utter was a simple, whistled note. Both birds kept to the undergrowth of the grove. The crest was carried erect. The iris was recorded as brown; maxilla black; mandible pale fleshy orange. The female had molted all her rectrices a short time before she was collected.

The two birds agree perfectly with the description of the type, except for slight discrepancies in wing formula and proportions. Their measurements are as follows: wing, (♂) 61.5, (♀) 59 mm.; tail, 64, —; culmen from base, 14, 13; exposed culmen, 12, 11; width of bill at nostrils, 5, 5; depth of bill at nostrils, 3.7, 3.2; tarsus, 18, 17.5; middle toe without claw, 9, 8.5; middle toe with claw, 12.5, 10.5.

The wing formula of the male (with the outermost primary numbered as 10) is as follows: $7 = 6 > 8 > 5 > 4 > 9 > 3 > 2 > 1 >$ secondaries > 10. In the female: $7 = 6 > 5 > 8 > 4 > 9 = 3 > 2 > 1 >$ secondaries > 10.

There can be no question about the generic distinctness of *Xenotriccus*. The much-rounded wing, lengthened tail in relation to the wing, long tarsus in relation to the wing or middle toe, and extremely developed crest set it off at once from its allies. It is probably most nearly related to *Empidonax* and *Mitrephanes*. The bill resembles that of certain species of the former genus; it is much narrower and with straighter outlines than the bill of *Mitrephanes*. The crest is much more developed even than that of the latter genus. Its actions, so far as I observed, resembled those of both *Mitrephanes* and *Empidonax*.

Spodiornis uniformis (Sclater and Salvin)

Haplospiza uniformis Sclater and Salvin, Nomenclat. Avium Neotrop.: 157, 1873, (Jalapa, Veracruz).

The genus *Spodiornis* contains three forms, all usually treated as full species, but which have lately been referred to the same formenkreis. *S. rusticus* (Tschudi), the best known form, has a rather extensive range in the Subtropical Zone of the Andes, from Venezuela and Colombia to Bolivia. *S. barrilesensis* Davidson was based on a single male from Chiriquí. Three other specimens from the Volcán de Irazú in Costa Rica have also been referred to this form although without direct comparison. *S. uniformis* of Jalapa still remains known only from the type. Only the female sex is known of *S. rusticus*, which is brownish olive and streaked.

I secured a female *Spodiornis* at Chiquihuite, Chiapas, on March 21, 1939. Chiquihuite is the uppermost 'settlement' (consisting of two Indian huts) on the southeast slope of the Volcán de Tacaná. On the day of our arrival at Chiquihuite a loud, chipping call attracted my attention to a sparrow hopping around in a bamboo thicket in a ravine. After shooting the bird I had an hour's hard work to recover the specimen. We left Chiquihuite on March 24 for the summit of the volcano, but found no further trace of *Spodiornis* there or elsewhere during three weeks work at various elevations on Tacaná. The altitude of the spot where the bird was collected was 2500 meters. I would place Chiquihuite about at the border of the Subtropical and Temperate zones. Perhaps it should be stated, however, that my interpretation of these zones is apparently not quite the same as Griscom's, since of the seventeen other species of resident birds taken at Chiquihuite, one is listed by Griscom as belonging to the Tropical Zone, two are assigned to the Subtropical Zone, five to the lower part of the Temperate Zone, and nine to the higher altitudes of the Temperate Zone.

The iris of my specimen was brown. The color of the bill was not recorded from the fresh bird, but in the skin the maxilla is blackish brown with the mandible distinctly paler. The ovary was 5.5 mm. long.

In view of the marked sexual dimorphism in this genus, the identification of the Tacaná specimen with *S. uniformis* can be considered only tentative, since it is a female and only the male sex is known of the forms occurring to the north and the south. In most cases other Subtropical Zone species of Jalapa, Tacaná, and Irazú are at least subspecifically distinct in all three places.

Compared with a female *S. rusticus* from Ecuador, the Tacaná bird differs considerably by being darker and browner (less olive) above and in having the crown and nape more heavily streaked. The ground color of the anterior under parts and flanks is brownish instead of golden buff, the belly is buffy rather than yellowish, the crissum is browner, and the streaks of the throat, breast, sides, and crissum are more prominent. The bill is considerably larger and stouter, as it is said to be also in the types of both *uniformis* and *barrilesensis*.

The measurements of the Tacaná female are as follows: wing, 69 mm.; tail, 46.5; culmen, 13.5; tarsus, 18.5; middle toe, 13. Its wing formula (with the outermost primary numbered as 1) is as follows: $3 > 2 = 4 > 1 > 5$. The outer primary is 2.5 mm. longer than the fifth and 4 mm. shorter than the longest (third) primary. This agrees pretty well with the wing formula of the type of *uniformis*, as given by Hellmayr (Novit. Zool., 13: 308, 1906).

Acanthidops bairdi, which Ridgway thought might be the same as *S. uniformis*, has quite differently shaped bill and wing. The female of that species has a

grayish chest and is unstreaked, besides showing other differences. The nasal fossae of *S. barrilesensis* are said to resemble those of *Acanthidops* rather than those of *S. rusticus*. The fossae of the Tacaná bird, however, agree with those of *rusticus* in being round in contrast to the long narrow slits of *Acanthidops*.

Another rare sparrow showing the same general style of coloration in the male sex is *Amaurospizopsis relictus* Griscom, known from a single male from Guerrero (Bull. Mus. Comp. Zoöl., 75, no. 10: 412, 1934). This, however, belongs to a different subfamily than *Spodiornis*. It has a stout, ridged, seedeater-type of bill and an entirely different wing formula. *Amaurospizopsis* is thought to be very closely related to *Amaurospiza*. The style of coloration of the female of *Amaurospiza moesta* is utterly unlike that of *Spodiornis*.—PIERCE BRODKORB, *University of Michigan, Ann Arbor, Michigan.*

Nesting of the Southern Robin in northwestern Alabama.—The Eastern Robin (*Turdus migratorius migratorius*) is a common winter visitor in northwestern Alabama, and but rarely lingers later than March 30. About that time the smaller, paler Southern Robin (*Turdus m. achrusterus*) puts in its appearance, overlapping the former, and it is now and has been for several years one of our most common nesters; every yard, lawn, and open shade-tree grove about town has one or more nesting pairs. A few years ago, a Robin was never known here in late spring or summer, and the only previous record I have of a nest being found or heard of, was in June, 1911, when a pair nested in a tree on the campus of the State Normal College at Florence. It seems that the Southern Robin has very materially increased its range southward within the last few years.—F. W. MCCORMACK, *Leighton, Alabama.*

Notes on some ducks collected in Kentucky.—Several scoter and scaup specimens in our collection seem to be of particular interest because of the limited collecting of waterfowl which has been done in Kentucky.

Greater Scaup, *Nyroca marila.*—We have two specimens of this species; a female and an immature male, both taken November 9, 1941, on the Ohio River, near Brandenburg, Meade County, Kentucky. Because of the great difficulty of positive field identification of the scaups, we believe these specimens to represent the first authentic record of the Greater Scaup for the state.

American Scoter, *Oidemia americana.*—Two specimens in our collection, both females, were killed November 9, 1938, near Carrollton, Carroll County, by Mr. Jacob P. Doughty of Louisville. These also were taken on the Ohio River. We reported them in a previous article (Monroe and Mengel, Kentucky Warbler, 15: 41, 1939) but full particulars were not given. They are apparently the only specimens for Kentucky.

White-winged Scoter, *Melanitta deglandi.*—November 6, 1938, two female specimens were secured near Twelve-mile Island in the Ohio River in Oldham County, by Monroe and Doughty (Monroe and Mengel, loc. cit.).

Surf Scoter, *Melanitta perspicillata.*—A female Surf Scoter was collected October 16, 1940, on the Ohio River near Brandenburg, Meade County, by Mr. James Fetter of Louisville, and is now in our collection. This appears to be the first specimen of this maritime species taken in Kentucky.—BURT L. MONROE, *Anchorage, Kentucky,* and ROBERT M. MENGEL, *Cornell University, Ithaca, New York.*

Krider's Hawk in Kentucky.—In our collection at Anchorage, Kentucky, is an immature female Red-tailed Hawk (*Buteo borealis*) taken October 16, 1940, near

Brandenburg in Meade County. Since this bird was of very light coloration we sent it to Dr. Josselyn Van Tyne of the University of Michigan, who returned it with the notation *"krideri"* (the quotations are Dr. Van Tyne's). Without entering the discussion as to the validity of *B. b. krideri*, we wish to record this specimen as the first example of this *type* of Red-tailed Hawk collected in Kentucky, so far as we have been able to ascertain.—BURT L. MONROE, *Anchorage, Kentucky*, and ROBERT M. MENGEL, *Cornell University, Ithaca, New York.*

Clark's Nutcracker in northwestern Michigan.—On October 4, 1942, I saw a Clark's Nutcracker (*Nucifraga columbiana*) in Gogebic County, Michigan, in the woods on the shore of Bass Lake near Mamie Lake. It was in characteristic woodpecker-like flight, less than 100 feet away; the white patches on the black wings were sharply visible as well as the whitish-gray head and neck. I am familiar with this bird, having seen it many times in the Rockies in different years. Dr. Van Tyne informs me that it has not heretofore been reported in Michigan. Roberts's 'Birds of Minnesota' includes it on the basis of five examples collected in that state.—WALTER T. FISHER, *949 Fisher Lane, Winnetka, Ill.*

Hoary and Greater Redpolls in Vermont.—On April 2, 1942, a Hoary Redpoll (*Acanthis hornemanni exilipes*) and a Greater Redpoll (*Acanthis linaria rostrata*) were taken at the banding station of Mrs. Elaine M. Drew in Barre, Vermont. The birds were sent to the author of this note who had them made into study skins. They were sent to Mr. James L. Peters of the Museum of Comparative Zoölogy, Cambridge, Massachusetts, who kindly confirmed the identification, and they are now in the Museum's collection. These specimens seem to be the first collected in Vermont although I banded a Hoary Redpoll on March 6, 1926, at Wells River. Perhaps Mrs. Drew's observations on the ratios of *exilipes* and *rostrata* to *linaria* may be of interest. During the period of February 24 to April 18, 402 Redpolls were banded, of which only two were *exilipes* and eleven *rostrata*.—WENDELL P. SMITH, *Wells River, Vermont.*

European Teal in Maine.—A collector of rubbish lately brought to me a small case containing seven stuffed birds which he had taken to dump. A glance showed that the case contained an adult male European Teal (*Nettion crecca*) still in good condition. I therefore took the lot, though no information as to the source of collection was to be had. Later examination of the birds indicated quite clearly that it was the work of Alexander C. Urquhart, the only local taxidermist, so far as I know, who used sawdust in stuffing; examination of the back of the case confirmed that conclusion as "Urquhart taxidermist" was painted thereon.

Urquhart's name appears in the Portland directories from 1868 to 1898 as a painter and grainer; from 1879 to 1882 as painter and taxidermist; after 1882 the "taxidermist" was dropped, though in 1898 the "painter" was dropped and "taxidermist" taken up again. Since his name disappears the next year, I surmise that, with failing health, he gave up his work as a painter and tried taxidermy as a less confining occupation. In any event the work is clearly that of Urquhart and apparently the collection was prepared during his vigorous years, or presumably the period of the late 1870's or early 1880's. The other birds in the lot are all species common to the region and there seems no reason to doubt that this teal, which appears to have been mounted from a fresh skin, was also of local origin.

The status of the bird in Maine is based on an adult male, taken "in Casco Bay," April 6, 1903 (Brock, Auk, 24: 94, 1907); an adult male taken a day or two prior

to March 26, 1910, in Scarborough, Maine (Norton, Auk, 28: 255, 1911). These are both in the Brock collection, now in the museum of the Portland Society of Natural History.—ARTHUR H. NORTON, *Portland Society of Natural History, Portland, Maine.*

Yellow-billed Tropic-bird in Maine.—A few days after the destructive hurricane of September 21, 1938, a specimen of *Phaëthon lepturus catesbyi* was found at East Winn, Penobscot County, Maine, about seventy miles inland. This specimen, which has been acquired by the Portland Society of Natural History through the estate of the late Walter J. Clayton, is an adult bird (sex unnoted), apparently in good health, though molt of its flight feathers was in progress. Counting from without, primaries 9 and 7 in the right wing are less than four inches long, while in the left wing, primaries 10 and 8 are about four inches long, and the third primary is about a fourth of the full length of that feather. It would seem that loss of these feathers had reduced the bird's powers of flight on that critical occasion, causing it to be driven before the gale to its doom.

This appears to be the first instance in which this bird has been noted in Maine. —ARTHUR H. NORTON, *Portland Society of Natural History, Portland, Maine.*

A method of remaking old bird skins.—Probably few of us who began making bird skins thirty or forty years ago, have what may be referred to as an artistically flawless collection. Certainly my own was liberally sprinkled with eyesores—the harvest of early, misguided efforts. So far as remembered now in respect to study skins, not a single pamphlet or book on taxidermy possessed in those days, stressed the prime necessity for using body-length neck sticks which fitted firmly into either the throat or the brain cavity. As a result of this, scores of my youthful specimens, with only a cotton filling, eventually developed broken necks, or the heads became twisted about and permanently set at violent angles. The bodies, too, through lack of support, often became distorted into unsightly caricatures. Another early and frequent fault was over-stuffing of the breast; this in conjunction with a lean neck imparted a grotesque appearance that unfailingly jarred upon one's sensibilities at every contact.

At long last I determined, to the best of my ability, to remake these offending skins so that they would more nearly conform to the superior product of today. Considerable experimentation was carried out at various times involving specimens ranging from warblers to the larger waders, etc. At first the faulty skins were immersed in water for relaxation and dried in warm sawdust; this orthodox method was certainly effective enough in softening the skins, but as anyone knows who has tried it, an excessive amount of time and labor is exacted for drying and fluffing the feathers. The following much simpler method was finally developed. It is to be understood that only smaller skins up to about medium-sized hawks have been so manipulated.

The first step is to sever the abdominal stitches with surgeon's scissors. By very careful use of the forceps all, or most, of the cotton filling can be removed without tearing the dry but somewhat flexible skin. With a long-nozzled syringe a small quantity of warm water is injected into the neck and skull through the ventral opening. Next, the body skin is gently swabbed inside with wet cotton and a quantity of this moist material placed there to carry on the work of relaxation. If the feathers are held out of the way with the left hand while this is being done they remain dry about the incision. It will be noted, in fact, that the feathers

do not come into contact with water anywhere and if discretion is used in applying moisture to the inside of the skin, they remain this way throughout the course of restoration. This preparation requires only three or four minutes. The skin is now laid away in a closed tin box where it will become soft and pliable in a few hours. It is a good plan to treat a number in this way the evening before the day on which they are to be made up.

After relaxing all night, the specimens are in ideal condition for a fresh start. All the wet cotton filling is now removed and the inside of the skin lightly dusted with arsenic and borax through the distended opening. This is merely an extra precaution to insure perfect preservation. It should always be done with specimens whose previous treatment is not known with certainty. (As a matter of interest it may be mentioned that arsenic was applied to all my specimens in the past and not a single one in over thirty years has been lost through the ravages of injurious insects. This is all the more notable because of the fact that for many years, while I was absent on Arctic expeditions, these specimens were packed in wooden boxes which were not insect-proof.) The process from now on is simply the best present-day one of making up a bird skin. To begin with, this means that a stick approximately equal to the length of the original neck and body of the bird is firmly wound with cotton to the proper size. The anterior end of this supporting stick is pointed and inserted in the beak and the latter tied shut. A few wisps of cotton will be needed here and there in the neck and body to shape them suitably. The abdominal cut is now closed with needle and thread for its entire length, and rents may be sewn up with a few stitches from the outside. At this juncture, or earlier, any grease which may have exuded on the belly feathers of water birds should be wiped away with carbon tetrachloride and thus made fresh and clean; this small area is then readily dried in fine sawdust and plaster. From here on, the mode of shaping and wrapping in a thin sheet of cotton is precisely the same as for a fresh specimen. In the final laying out, many specimens are brought into better alignment by pinning on a board at beak and feet; the tail is also spread at this time.

Greatly favoring this method is its extreme simplicity and the ease with which the skins can be remade. As noted, the feathers remain dry throughout the treatment, so that no tedious drumming is required and one proceeds directly to the making of the specimen without any preliminaries whatever. At no time is the skin turned inside out. By this system the wings are not relaxed, but this seldom gives any trouble if they were originally set more or less correctly to the body and they now readily fall back into place again. In some instances they are somewhat springy with a tendency to lateral bulge, but this is easily overcome with an invisible stitch through the body over a couple of primary feathers on either side, near the bend of the wing; the flanking feathers naturally come down and cover the edge of the latter with a little persuasion from the forceps. There is really very little reshaping to be done, as, initially, most of the bad outline and structure was confined to the breast and neck. Specimens dry strong and ready for the cabinet in three or four days.

In the long-necked waders I prefer a stiff wire instead of a stick in the body and neck. The wire is sharpened at one end and pushed through the skull and skin at the forehead; the beak may be arranged straight in line with the body, or the neck slightly curved and the head turned flat on its side with the bill at an angle of 25 or 30 degrees. When the specimen is set, the wire is snipped off

out of sight below the feathers. Long beaks (godwit, curlew, avocet, etc.), which have a tendency to remain open along the terminal half, can be cemented together with adhesive and temporarily tied shut at two or three points until the substance hardens; as the surplus is removed, the cement does not show and makes a firm, neat job.

By the above procedure (following relaxation) a couple of dozen small birds can be completely restored in the course of three or four odd hours over a week end; winter is naturally the best time for such renovations. The work is pleasant with little fuss and specimens can be remade much more rapidly than when originally preserved. In most cases specimens so treated come out clean, strong and beautifully symmetrical and scarcely to be distinguished from the finest, comparable material in the collection. In the nature of things, not every specimen can be made perfect; however, if care is used, it is impossible to restore a poor skin without at least achieving radical corrections. Thus, in nine cases out of ten, old, disreputable skins can be improved beyond recognition and thus become not only a pleasure to possess and handle, but also of increased value for comparative purposes.—J. DEWEY SOPER, *Winnipeg, Manitoba.*

A correction.—In an article entitled "Food of Some Uncommon Birds" by Clarence Cottam and Phoebe Knappen [Auk, 56 (2): 138–169, April, 1939], reference is made on page 147 to a specimen of European Widgeon collected at Monroe, Michigan, by 'W. B. Tyrell' on April 3, 1927.

Mr. W. B. Tyrrell informs us that this is an error, that the bird was not a European but an American Widgeon. The error was made by a member of the Biological Survey staff in accessioning the stomach. Because of the relatively few published records of the European Widgeon, it has seemed advisable to publish this correction.—CLARENCE COTTAM, *Fish and Wildlife Service, Chicago, Illinois.*

RECENT LITERATURE

Birds of India.[1]—The principal purpose of this booklet is to illustrate in color and describe all of the more common birds of the Indian Peninsula. It includes pictures of 181 species while of others only a description is given. The colored plates do not come up to the standards of American bird books, but they are sufficiently good to permit quick identification. The text and particularly the descriptions of the habits contain a considerable amount of original data. Interspersed with the systematic sequence of the birds are short chapters on "Nests and Nesting Behavior" (pp. 92–104), on "Bird Migration" (pp. 190–200), on the "Usefulness of Birds" (pp. 289–296), and on "Bird Watching" (pp. 390–394). A great deal of this is based on the author's own extensive experiences as a field student of Indian birds. The booklet is obviously meant for the amateur but it seems to contain much information of interest to the expert. There is no doubt that it will accomplish the purpose for which it was published by the Bombay Natural History Society, namely "to popularize nature study" and to create public opinion in favor of the conservation of the Indian fauna.—E. MAYR.

Bird behavior.[2]—Although the present work has as its major title, "Bird Display," the breadth of the subject is better expressed by the secondary title, "An Introduction to the Study of Bird Psychology," as a glance at the chapter headings will show. 'The Evolution of Nest Building,' 'Courtship Feeding,' 'Disablement Reactions,' 'The Expression of the Emotions,' 'The Evolution of Social Ceremonies,' 'The Social Hierarchy in Bird Life,' and 'Territory, Song, and Song-flight' are but some of the subjects there listed and there are still others discussed though not mentioned by title. Such a large share of a bird's activities are a part of its emotional life that many actions that might appear to be unrelated are, in reality, part of the same psychological picture. Great strides have been made in comparatively recent years in getting an insight into the nature of the world in which a bird lives, and a very different world it is from what was supposed even a generation ago.

So much has been done by workers in different places and their findings have been published in so many diverse journals and books, that it is undoubtedly difficult for many students to follow all of the current developments. Mr. Armstrong has made a useful contribution by collecting these scattered accounts and extracting the pertinent facts for comparison with each other. Thirty-one pages of bibliographic references attest to the amount of material that has gone into the present account.

The text is not, however, a compilation of quotations. It is a readable discussion of the vast complex of reactions to internal and external stimuli that make up so much of the bird's behavior pattern, noting the conflicting observational data and the theories that have been adduced therefrom with Mr. Armstrong's own interpretations added. Anthropomorphism has lost its early standing and finds no place here. The book thus serves not only as a mine of digested information but

[1]Ali, Sálim. 'The Book of Indian Birds.' 16mo, xxxix + 395, incl. 192 pls. (171 col., depicting 181 species, 3 line, and 18 half-t.), 1 map, 1941. The Bombay Natural History Society, Bombay. Price, 14 rupees.

[2]Armstrong, E. A. 'Bird Display—An Introduction to the Study of Bird Psychology.' 8vo, xvi + 381, pls. 1–22, 1942. The University Press, Cambridge [England]. The Macmillan Company, New York. Price, $5.50.

points out fields where further work needs to be done. The field for further research is still wide.

Vernacular names have been used for the birds in the general text but the scientific names are tabulated in systematic order in a special list. The bibliography has already been mentioned. There is a three-part index—one part for the animals discussed, one for the subject matter, and one for the authors whose observations have been used. The pages of the general text are free from lengthy documentation. Twenty-two plates contain forty well-chosen photographs from various sources illustrating different types of avian behavior.—J. T. ZIMMER.

Records of bird songs.[1]—A number of years ago, the late Albert R. Brand commenced his activities in the recording of bird songs and, from time to time, offered to the public various phonograph records to which had been transferred the most outstanding results of his labors. Various articles also appeared in print describing the methods used as well as certain of the more technical data that had been obtained from the original recordings on films.

After Mr. Brand's untimely death in 1940, the work that he had begun was continued by the Foundation established for the purpose, under the supervision of Dr. Arthur A. Allen and Dr. Paul Kellogg. The present series of records embodies the latest selection from the extensive file of recordings that has been built up. Comparison with earlier records shows a marked improvement. Background noises have been reduced to a noticeable degree. There are still some differences in the degrees of accuracy with which the birds' voices are reproduced, much of which is probably due to the different pitch and quality exhibited by the birds in life, which register unevenly. Part of this irregularity can be overcome by varying the adjustment of the machine on which the records are played. Some of the records appear to sound better on an old-style phonograph without a loud-speaker and others are better on the more modern instrument. Some are improved by a little distance and others not.

In any case, the voices here demonstrated are more than just recognizable and many of them are excellent. There are six species represented on each side of the six records, making seventy-two in the complete set. They are classified as the birds of the northwoods, of northern gardens, of the fields and prairies, of southern woods and gardens, and of western North America, and North American game birds. Those persons wishing to identify unfamiliar bird notes will find these records of considerable service, and those who already know their bird songs will enjoy hearing them again through this medium. Single records are on sale at the price of one dollar each.—J. T. ZIMMER.

Animal portraiture.[2]—This album of photographic illustration of various mammals, birds, and reptiles to be found in the National Parks of the western part of the country is offered as a contribution for the enjoyment of camera enthusiasts and interested visitors to the areas in question. It is not a manual for the naturalist. Thirty-five species of mammals, fourteen birds, with the addition of a miscellaneous group of waterfowl, and two reptiles are shown in interesting attitudes. Mr. Dixon has supplied a short text for each species, describing some of its characteristics

[1] Albert R. Brand Bird Song Foundation, Laboratory of Ornithology, Cornell University. 'American Bird Songs.' Album with six double, 10-inch records. Comstock Publishing Co., Inc., Ithaca, N. Y., 1942. Price, $5.00.

[2] Dixon, Joseph S. 'Wildlife Portfolio of the Western National Parks.' Imperial 8vo, xii + 121, 121 figs., 1942. U. S. Dept. Interior, Washington. Price, $1.25.

and giving pertinent anecdotes from his rich experience in the field. A list of the species is prefixed with the names of the principal western National Parks and National Monuments where each may be most readily found. Visitors to the parks should find the collection both useful and entertaining.—J. T. ZIMMER.

Biographies of ornithologists.[1]—In a most interesting volume, Colonel Hume has brought together a surprising amount of biographical information about thirty-six one-time members of the United States Army Medical Corps (two are still living) who have left their impress on American ornithology. Some of these men, like Charles E. Bendire, Elliott Coues, E. A. Mearns, and R. W. Shufeldt, need no introduction since they left a quantity of writings published under their own names, but even about these men Colonel Hume has succeeded in assembling many unfamiliar facts that add to our acquaintance with their backgrounds. Some of the other members of the Corps are less well known to us although their names, perhaps, have appeared from time to time in articles by their contemporaries. Some of them were detailed on service in the western part of the country when that area was being opened to exploration and settlement, and their activities in the field added much to our knowledge of the birds of the regions they visited. Their collections and commentaries were invaluable to Spencer Baird and others in the preparation of their epochal reports on the bird life of the newly opened western territory.

Still others found opportunity in foreign countries or in the laboratory to make important contributions to various branches of ornithological science. The record of the Corps is one not only of preëminence in medical service but of collaboration in different branches of zoology, and ornithology has been among the favored fields. The present volume performs a service of importance in presenting interesting facts about the lives of the men who were responsible for this effective collaboration.—J. T. ZIMMER.

Mayr's 'Systematics and the Origin of Species.'[2]—This is another distinguished member of the group of outstanding books comprising the Columbia Biological Series. Although of broad zoological import, it is particularly of interest to ornithologists because of the wealth of illustrative material drawn from birds and the leading rôle that ornithologists have played in developing taxonomic methods. Its main purpose is to review the contribution that systematics of the most up-to-date stamp can make to the study of evolution and particularly to that critical phase, the origin of species. It is both a defense of systematics, if indeed that be needed, and a critique of its procedure and outlook, past and present. The nexus of genetics and systematics, so worthily developed in Dobzhansky's recent book ('Genetics and the Origin of Species,' 1937), is thoroughly reflected by Mayr, although the details of the genetic facies are, properly, not repeated.

The early part of the work, especially chapters 1 and 2, is a sound elementary exposition of taxonomic procedure which may well serve as a manual for beginners in the field. We have lacked such an item in English equivalent to Rensch's 'Kurze Anweisung fur zoologisch-systematische Studien.' There follows a detailed, orderly treatment of phenomena of geographic variation—different types of characters involved, gradients, kinds of intergradation, and population structure, to

[1] Hume, Edgar Erskine. 'Ornithologists of the United States Army Medical Corps.' Super-royal, 8vo, xxv + 583, frontisp., figs. 1–109, 1942. Johns Hopkins Press, Baltimore. Price, $5.00.

[2] Mayr, Ernst. 'Systematics and the Origin of Species, from the viewpoint of a zoologist.' 8vo., xiv + 334 pp., 29 figs., 1942 (copy received December 15). Columbia University Press. New York. Price, $4.00.

mention a few. No attribute of animals seems to be immune to heritable geographic variation and consequently all characters of full species may be modified in this way.

Chapter 5 which deals with the "new species concept" is the most contentious section of the book. Perhaps too much stress is placed by Mayr on definitions. I can not wholly agree that "a concise definition of the species is, for . . . [the student of evolution], a necessity, because his interpretation of the speciation process depends largely on what he considers to be the final stage of this process, the species." If, as Mayr correctly insists, there is a continuity of evolutionary process up through the species to the generic level and if the student carries through to this level in his analysis, the setting of rigid limits of the species stage becomes rather academic. But, actually, I think Mayr's definition of a species is thoroughly good and it is more widely acceptable to ornithologists than one would gather from his discussion; indeed in its essentials it has been put in practice by them for several decades in this country. His statement in shortened version is: "Species are groups of actually or potentially interbreeding natural populations, which are reproductively isolated from other such groups."

Always there is the problem of dealing with instances of interrupted distribution and the question of how complete the reproductive isolation is to be before the species stage is reached; after all there are going to be borderline examples and interpretations whatever the definition. Mayr appreciates this and throughout he seems more tolerant of others' views and more sensitive to necessary qualifications of statement than in some of his earlier papers and reviews. Still, occasionally, particular examples are unduly warped to accord with his preconceptions. His treatment of the garter snakes is a case in point. Here, unless we are to deny the validity of Fitch's basic data, we have a most unusual situation in which three groups of races on the Pacific coast overlap each other geographically, yet between the groups in some areas there is normal intergradation. There really is a branching chain of races, considerable segments of which overlap spatially without interbreeding. Mayr boldly reinterprets this situation, explaining that the intergradation between the three groups consists of hybrid populations and implying that these junctions differ in character from the intergradation between member races of a group. I can find nothing in Fitch's account of the details of these intergradations which can justify Mayr's contention. The meeting of groups may involve secondary intergradation or hybridization, whereas that between members of a group may be primary intergradation, but in any event reproductive isolation of the groups is lacking. In dealing with other examples Mayr demands a high degree of reproductive isolation before recognizing groups as separate species. Perhaps this merely illustrates how difficult it is both for original worker and compiler to be completely consistent in applying a species concept.

A point that the author makes forcefully and appropriately is that reproductive isolation does not necessarily mean sterility. A host of factors is involved in the reproductive isolations of nature, and obviously it is only under natural conditions that speciation takes place. Ability to cross in captivity is not a decisive test.

One element of style in writing proves annoying. It is the excessive use of the word "modern." Indeed, through repeated reference to the "modern worker," he creates an illusion of a caste of modernists arrogantly assigning to themselves a favored position in their science. Mayr would of course regret such a spurious impression.

Thoroughly good is Mayr's system of terms for geographically variable species

(polytypic, as against monotypic) and for geographically complementary species (allopatric, as against sympatric) which may constitute superspecies. Polytypic species and superspecies may be substituted for Rensch's German terms, "Rassenkreis" and "Artenkreis." Some highly instructive discussion pictures the transition from a polytypic species to two or more allopatric species and finally to sympatric species that live together in the same region. Mayr is convinced that most species are formed by the geographic process, rarely if ever aided by ecologic isolation *per se* in the initial stages. Geographic isolation is essential to permit reproductive isolating mechanisms to arise. Little evidence is found for "instantaneous sympatric speciation" among animals.

In the final chapter on higher systematic categories, a distinctly practical approach is advocated and the differences between "lumpers" and "splitters" are nicely illustrated. "The genus is . . . based on a natural phenomenon." But, "the genus of the systematist in his own artificial creation, and not a natural unit." He concludes that "all the available evidence indicates that the origin of the higher categories is a process which is nothing but an extrapolation of speciation. All the processes and phenomena of macroevolution . . . can be traced back to intraspecific variation . . ."

The student of systematics and evolution, as indeed the general biologist, is certain to be stimulated by this excellent book. Mayr's presentation is lucid, rich in examples, and can not help but improve the concepts of even the most experienced workers in these fields whether or not they see eye to eye with him on all issues.—ALDEN H. MILLER.

The Roseate Spoonbill.[1]—Mr. Allen spent sixteen months in the field and other time in library and museum, assembling a great variety of information regarding this beautiful species, particularly as concerns its life within the borders of the United States. A large share of the accumulated data came from his own careful work in the field and much that is presented here is not to be found elsewhere in print.

The Roseate Spoonbill once was more common as a nesting species in the southern portion of the United States than at present. Down to about 1830 it was little affected by man but shortly thereafter showed such unfavorable reaction to his presence that some time after 1850 it virtually disappeared from the North American scene although it still remained in areas outside our borders. The disappearance was due in part to deliberate shooting or destruction of eggs but, probably in largest part, because the birds are hypersensitive at nesting time and will desert their nests at slight provocation, even lacking direct contact or injury. Owing to a littoral habitat, drainage and cultivation have caused little damage. Predation by Great-tailed Grackles and raccoons is definitely a serious factor but parasites and disease are not particularly deleterious, at least over extended periods.

At any rate, after the spoonbill was gone from most of its former haunts in the United States, efforts were made to encourage its return and results were favorable in Texas but not in Florida where, even now, the species rarely breeds on the mainland. The exact explanation for this discrepancy has not been determined, but in his search for the clue, Mr. Allen has recorded a wealth of information concerning the life-history, behavior, and requirements of the species.

[1]Allen, Robert Porter. 'The Roseate Spoonbill.' Research Report No. 2 of The National Audubon Society. Imper, 8vo., xviii + 142, frontisp. (col.), pls. 1–20, text-figs. 1–44. New York. Price, $2.50.

The Roseate Spoonbill is classed as of the *cichlid-fish type*, with releasers in both sexes, display by both sexes, and no dominance order. However, it is at the bottom of a peck order in a mixed colony of various species. The female constructs the nest but the male is active in bringing material for it. The male, alone, defends the nesting area and the territory is reduced from its original limits at least until the eggs are laid. Both sexes incubate. Eggs are one to four, averaging 2.7, and are laid, probably, one every other day, beginning the sixth day after the first observed copulation of the parents. They require 23–24 days incubation. The sexes remain together until the brood is raised.

A study was made of various feeding areas to determine the spoonbills' niche, which appeared to have, as outstanding requirements, shallow water, fresh or saline, and a sufficiency of small animal life for food. Examination is made of the structure of the bill as related to feeding activities. An analysis of stomach contents, a study of the other animals of the community, and an examination of the food of the associated birds contribute to the data.

Plumage and molts are discussed in some detail. A total of 33–36 months is required to reach adult plumage in which, alone, the bird breeds. General distribution, migration, and post-seasonal wanderings are examined although the Central and South American data are not complete. Most of the present-day occurrences of spoonbills in Florida are found to be of young birds or other nonbreeders.

As recommendations for future conservation measures, Mr. Allen suggests further study of the species in the tropics, protection throughout its range, and its inclusion among the species listed in migratory bird treaties. Complete protection in this country should include freedom from disturbance during the nesting season. These measures should encourage it to return in increasing numbers to its former haunts which appear to be still intrinsically favorable for colonization by this interesting bird.

A colored frontispiece by Roger T. Peterson and numerous fine photographs and line-cuts give adequate illustration to this important report.—J. T. Zimmer.

Birds of Burma.[1]—This volume was mailed to me on Feb. 18th, 1942, two days before the evacuation of Rangoon, but managed to reach me in some miraculous manner. It is a popular handbook giving concise information on all the birds (species and subspecies) that have so far been recorded from Burma. Stuart Baker's nomenclature and sequence of species is followed, on the whole, although Ticehurst's recent work is fully utilized. The field notes contain much of interest. The most important part of the book for the professional ornithologist is a checklist of the birds of Burma, with notes on their occurrence in the 13 principal geographical subdivisions of this country. The color plates, illustrating 290 species, are a pleasant surprise by uncovering a new bird artist, A. M. Hughes. Although the poses of some of the birds are a little stiff and the colors occasionally rather flat, these plates are very much better than those in any of the other popular books on Indian birds. They are the portraits of live birds! The entire unsold edition was apparently lost during the occupation of Rangoon, but I hope Mr. Smythies can go through with his plan of a second edition.—E. Mayr.

The Vertebrate eye.[2]—At first glance, one might think that here was another

[1] Smythies, B. E. 'Birds of Burma.' With 31 colored plates from paintings by Lieut. Commander A. M. Hughes. 589 pp., 1 map. American Baptist Mission Press. Rangoon, 1940.

[2] Walls, Gordon Lynn. 'The Vertebrate Eye and its Adaptive Radiation.' Cranbrook Institute of Science, Bull. No. 19; 8vo, xiv + 785, frontisp., pl. 1, figs. 1–197; Aug., 1942. Price, $6.50.

weighty book for students of anatomy and physiology, important and apparently exhaustive, but not a book to be read through, page by page. Such conclusions, except as regards importance and completeness, would be quite erroneous. Dr. Walls's knowledge of his subject and his happy faculty of clear expression have enabled him to produce a work that can be read from cover to cover. The reader who is at all interested in the subject matter will be likely to find that it is difficult to put the book down.

Beginning with a basic discussion of light and its perception, the structure of a typical Vertebrate eye and its appurtenances, its functional usage, and its evolution and development, the author then passes to the wealth of adaptive modifications to which the eye is subject in different animals and concludes with a synoptic treatment of this organ in the different classes of the Vertebrata. Whether the reader wishes to learn of the structure of the eye or its evolution, the mechanism of color perception, the reason for a cat's linear pupils, the purpose of the perfect decussation in the optic chiasma of mammals in contrast to the imperfect condition in other Vertebrates, the suggested explanations of the pecten in birds, or any other of the myriad details that may come to mind regarding the eye in these higher groups of animals, he will find something about it here. Not only are the current beliefs expounded, but the theories, as well, that have been advanced in the past and the reasons for their abandonment or modification if they are no longer tenable.

Dr. Walls has avoided the interruptions of bibliographic references in the text and has thus kept the thread of his discourse free, but there is an excellent bibliography at the close of the volume where these references may be found. He, furthermore, writes with an exceedingly light hand, considering the weight of his subject, and enlivens the text with frequent humorous allusions or turns of phrase that often serve to bring home the points he makes with added force. The profusion of diagrams and figures throughout the volume furnishes adequate illustration.

After first perusal, the reader will want to keep the book at hand for ready consultation, for which purpose a good index is supplied. One can wish only that a more serviceable color could have been used for the binding since the white covers are likely to suffer through the use to which the volume is sure to be subjected.—J. T. Zimmer.

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locally resident birds, the gonads of the adults do not regress so far in the summer and begin a slow development again in the autumn, accelerating rapidly in the spring. The birds have a permanent attachment to their nesting sites, even roosting in them during the winter, and during the autumn and winter there is some exhibition of sexual behavior. The hormonal development in the autumn inhibits migration away from the nesting grounds.

The migrants from the Continent show no interest in any nesting holes, their gonads regress farther than those of the other group and do not start growth again until spring when they develop more slowly, and this growth impels return to the breeding areas on the Continent.

Owing to the difference in seasonal activities and physiological development of the two groups, the seasonal change of color in the birds' bills shows noticeable distinctions at any one time and there is also distinction in respect to the amount of wear shown by parts of the plumage in the birds that frequent nesting holes in winter and those that do not.

On the basis of these various characters, the author proposes to separate the British birds as a physiological subspecies to which he applies the name *Sturnus vulgaris britannicus*. The separation appears to be eminently justifiable, but the question arises in the mind of the reviewer as to whether the earlier name *guttatus*, applied to British birds by MacGillivray (Hist. British Birds, 1: 595, 1837) will not have to take precedence. Some restriction of type locality may be necessary to assure the application of *'guttatus.'*

The paper gives a mass of details regarding morphology, histology of the gonads, and behavior of the two groups of birds in the various seasons and ages and of both sexes. It is an important contribution to a branch of ornithology, physiological subspeciation, which has received far less attention heretofore than its morphological equivalent.

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CORRESPONDENCE

Subspecific Values

Editor of 'The Auk':—

By general concept, the subspecies is a minor genetic group within the species. Theoretically, within a highly variable species, their number may be infinite, but practically the number to be recognized within a species is limited by the technique and ability of observation. Most of the broader and more easily recognized variants of North American birds have been described and named, and present systematists within the field have been reduced to concentration upon finer and finer distinctions and the exercise of nicer and sharper discriminations. The more any one studies a subject the more he can see in it. An ample series of material and long, intensive examination of it are almost certain to reveal refinements inappreciable to a cursory survey or to those who lack the opportunity or equipment for equal concentration upon the particular subject. To study all the species that may be concerned thus intensively is beyond the limits of most working life-times. It follows that the ordinary, or even the unusual, ornithologist, unable personally to test all dicta that may be advanced, must accept some of them with slight or no verification, placing strong reliance upon the known personal equation of the proposer and his habits of thought and work. It is not that these distinctions do not exist, but that some of them are too fine for ordinary resources, and may, in fact, in extreme cases, be recognizable only to highly gifted, specially developed senses, or in long series of pertinent material. The danger of thus having to accept authority without verification is obvious, and raises the question as to how finely it is *expedient* formally to split and to demand universal recognition therefor.

Every possible variant, no matter how slight, is legitimate field for investigation. In fact, slight superficial differences may be accompaniments of those of more fundamental but less obvious importance. Unfortunately we are quite unaware of the essence of specificity. The morphological guides upon which we base our diagnoses are largely adventitious accompaniments of specificity, not its basis. A Song Sparrow is a Song Sparrow, not because of certain spots, stripes, colors, size and proportions, but it bears these significant insignia because it is a Song Sparrow. It is quite possible for two birds to be so much alike in their gross morphology as to be inseparable to our senses, yet fundamentally be genetically, even specifically, distinct. Some of the *Empidonax* flycatchers approximate this condition and others, unknown to us, may carry it still farther. Two grains of wheat may be indistinguishable even to the expert, yet vary widely in their ripening period and resistance to drought, disease or insect attack. One strain of mosquito may be a dangerous vector of disease, and others indistinguishable from it may be harmless. Something similar may be true in some of our minor bird strains. That they are exclusively limited in their ecological, climatic and geographical reactions indicates that they contain certain inherent constitutional factors that render intolerable to one what may be tolerable or even necessary to the other.

All this may be philosophical justification for the finest splitting possible, but it does complicate our taxonomic system to a degree that greater features may be hidden amidst the lesser ones. One may not be able to see the forest for the trees. The trouble is that all such recognizable variants, the large and the small, the material and the immaterial, are represented in the system as of equal weight,—they are all subspecies without qualifying distinction. An example may be the

Fox Sparrow, *Passerella iliaca*. There are three well defined and easily recognized races or groups of races within the species, represented by reddish *iliaca*, slaty *schistacea* and chocolate *unalaschensis*. To date *iliaca* has not been successfully split into subvarieties, but *schistacea* has been more or less divided, and *unalaschensis* has been split into many races upon finer and finer characters of varying stability. We do not here question the validity of any of these lesser forms but submit that the above *iliaca, schistacea* and *unalaschensis* groups are of higher taxonomic order, yet in our formal system all are represented as of equal weight and importance, nor is there in general literature or usage, any word of warning that all subspecies are not of equal value or desirability of recognition.

Describers are often to blame for some of this. Perhaps enthusiasm carries them away, or concentration upon minutiae warps their sense of proportion. Terms like "decidedly larger," "much darker" and the like are freely sprinkled through their diagnoses when in fact weaker adjectives are called for. And we are more and more differentiating averages. We are not here referring to intergrades of the nature of hybrids that naturally occur near the common boundaries of closely allied races, but to individual variations within the centers of distribution of the specialized forms where a comparatively pure line of descent should occur. A group may average larger or smaller, lighter or darker, yet no single individual may be certainly determinable of itself without reference to its geographical origin. There may be theoretical or even practical justification for doing this, but the process has already brought some discredit upon descriptive zoology, and is it *expedient* to lumber up our general system with indeterminables? That these minor divisions should be studied and delimited genetically and geographically is evident, but do they all require particularizing 'name-handles,' and if so, should such names be presented as of equal value and weight with other entities of more direct and evident importance?

One method of making distinction between the lesser and the greater would be to revive the old term 'variety' (var.) or something similar, as 'strain' which is well understood, expresses the relation, and has not had previous use, in a new sense of sub-subspecies. This, unless used only upon particular occasions as is done with the generally disregarded subgenus, would in effect be to introduce quadrinomials into an already extended trinomial system and in practice it might produce differences of opinion that might complicate almost as much as it would simplify. In any case it would be strongly resisted and is, perhaps, impractical however theoretically desirable.

What can be done, however, within the framework of the present system, is to demand more restraint in formally naming the finer results of investigations and to bear in mind and to stress that all subspecies, even those that find full-fledged support in authoritative check-lists and legitimate use in specialized research, are not of equal value, and that the necessity or advisability of individual recognition of them varies with the case and the circumstance of their use and application.—

P. A. Taverner

Ottawa
Canada

'Birds and Wind'

Editor of 'The Auk':—

In the October, 1941, issue of 'The Auk,' Mr. W. L. McAtee claimed that in 'Birds and the Wind,' (Bird-Lore, Nov.–Dec., 1938) I over-simplified matters. In

the July, 1942, issue of 'The Auk,' Mr. Francis H. Allen, writing in my defense, believes that Mr. McAtee is probably right. I agree also. I, no doubt, did oversimplify the problem.

The primary principle that the net movement of a bird, as we watch it from the ground, must always be the result of its own movement through the air and the movement of the air in relation to the ground is simple enough. The problem, itself, however, is complex. No two species of birds fly exactly alike; different birds have different wing-loading, lift and speed and the wind as we know it is never the result of but one motion but is usually the result of several motions occurring simultaneously.

Mr. McAtee has kindly pointed out faults in writing, which Mr. Allen felt it necessary to defend by saying that Mr. McAtee took me too literally. Aside from these faults, it seems to me that the real issue is in different conceptions of the wind. Personally, I believe that when we study a flying bird we should take the bird's viewpoint of the wind and not the traditional ground view.

As we stand on the earth in a wind, it seems obvious to us that the air is moving and that it is striking us with a force that varies as the square of the speed. In fact, we define wind as "air in motion" and in writing 'Birds and the Wind' I oversimplified matters by holding to that definition. That definition, however, begs the assumption that the earth is stationary. We need only watch the sun to know that the earth also moves. Both the air and the earth move and what we know as wind can only be relative motion, or the difference between two motions, and not a true motion. That relative motion can have no force except at the plane of collision between the two moving elements. A simple rule would be that no object can feel the force of the wind unless it is both on the moving earth and in the moving air at the same time.

To illustrate, let us assume that we have two parallel railroad tracks with a train on one moving at 30 miles per hour and a train on the other at 40 miles per hour. The relative motion between the two—or what we might call a "railroad train wind"—is 10 miles per hour. Unless he puts out his hand and touches the other train, that 10 miles per hour has no meaning to a passenger in either train. He can sit, or stand, or walk, or climb up and down and not be affected in the least by the fact that the two trains are moving in relation to each other. If we call one train "air," then a bird can move at will in it and not be affected by the fact that the earth is moving under him. He will, of course, go where the air goes, just as a passenger must go where the train goes. If the air goes up, the bird will go up, just as if the tracks spread and the two trains moved away from each other. If the tracks approach each other, the trains will move closer together. If air and earth approach each other, the bird will come down.

If a passenger on one train looked out at the other and had no third object, or background, for comparison it would be impossible for him to tell whether it was his train, the other train, or both that moved. From far back in the mists of time we have always assumed that our train was stationary and that it was the other train—the air—that moved. A passenger in the other train could make the same mistake and assume that the entire relative movement was in the earth and that the air was stationary. That is the viewpoint of the bird.

If we take the bird's viewpoint that the air is stationary, it is easier to understand why there is no force that can strike, hinder, maim or kill a bird. The air does move, of course, at a terrific rate if we measure its movement with reference to

the sun. But the bird is no more conscious of that movement than we on earth are conscious of the movement of the earth and for the same reason. The bird is a part of the movement of the air just as we are a part of the movement of the earth. We find it no more difficult to walk west against the rotation of the earth than east and the bird is just as free to move in the air.

If we accept the bird's viewpoint, a tail wind can be defined as that condition where the point on the earth that the bird would like to reach is coming toward him. A head wind would be the condition in which a bird would literally have to chase the earth. That would probably necessitate an increase in the speed of the bird. An airplane can double its speed only at the expense of cubing the power, which comes about in this way. With no resistance to overcome, doubling the power would double the speed. But air has substance and doubling the speed doubles the force with which the airplane strikes the air, and the power must be doubled to overcome it. Doubling the speed also doubles the amount of air struck in any interval of time and the power must again be doubled. Even if I grant that many birds can change the angle of incidence and wing area and thus reduce resistance, the energy necessary to get anywhere in a fast head wind must soon exhaust the bird.

To make a vivid example let us suppose a bird has enough energy to cruise at 20 miles per hour for eight hours. If he rides a tail wind of 20 miles per hour (when the earth is coming toward him at that speed), he will in eight hours arrive at a point 320 miles from his starting point. If, however, he flies in a head wind of 20 miles per hour, (when he must fly after the earth) he must increase his speed or not move at all in relation to the earth. If he doubles his speed, he will, in one hour burn up all of his eight hours of cruising energy and be but 20 miles from where he started. In my opinion, only humans are in such a hurry that they will deliberately fly under those conditions.

In the article 'Birds and the Wind' I made the statement that "a flying bird, which is essentially a part of the wind, cannot be struck by it any more than a man can be struck by the automobile in which he is riding." Mr. Allen writing in my defense says that "a man *can* be struck by the automobile he is riding in if the brakes are put on too suddenly." I would like to ask if it is not true that it is the man who strikes the automobile rather than the auto which strikes the man? When the machine stops, the man continues to move and will strike the windshield with a force that varies as the square of the speed. Which brings me to turbulence which Mr. McAtee confused with wind.

The highroad of the air is not always smooth any more than a highway on earth. Pilots do avoid thunderstorms as Mr. McAtee claims and for the same reason that he would avoid an extremely rough road if he could not decrease the speed of his automobile. There are waves and eddies and "bumps" in the air but the bumps do not hit the bird and airplane so much as they hit the bumps. If we had a bump on a highway on earth we could park an automobile on it and nothing would happen to it. At a speed of ten miles per hour we could drive over the obstruction with no ill effect. But if we hit the bump at eighty miles per hour we would strike with sixty-four times the violence as at ten—the ration of ten squared to eighty squared—and we might wreck both the automobile and ourselves.

If we can accept the average cruising speed of a bird as 20 miles per hour and an airliner as 160 miles per hour, then the airliner is going to strike turbulence with sixty-four times the violence of the birds. Inexperienced pilots have wrecked airplanes in thunderstorms by building up their air speed instead of decreasing

it to a safe minimum. Can any bird fly fast enough to kill itself in turbulence? Personally, I doubt it. I find it hard to believe that birds could commit mass suicide in that way and I find it impossible to believe that wind could cause a massacre. As Mr. McAtee says, there are records of dead birds falling but I would hazard the guess that sometime before they had been carried so high that they starved for oxygen. Or, perhaps, lightning was the cause. We who fly in modern airplanes are virtually inside Faraday cages and are protected, but are birds? In attempting to find an answer to one airplane crash, authorities guessed that concussion from a near bolt of lightning stunned the pilots. That might be the reason for the bird mortality. These are only guesses but I believe they are better guesses than that wind killed the birds. From the bird's viewpoint that is impossible.

Wind can be the "great and good friend" of the birds if they choose to make it so. No doubt, they do occasionally make mistakes and get on the wrong train to be carried off course. Personally, I can do little less than marvel at how often I have found them riding the right train even above the clouds out of sight of land. How they know is, quite frankly, a mystery to me. I am beginning to suspect that sound has something to do with it. We who fly in noisy silence are apt to overlook the fact that birds must be able to hear not only sounds originating on the ground but their own reflected cries. The sonic altimeter for aviators is still in the experimental stage. The birds may have been using it for centuries. At least they should be able to tell from their own echoes whether they are over land or water.

In conclusion, it seems to me that the real issue between Mr. McAtee and myself is not whether I made mistakes in writing but whether it is correct to use our view of the wind or the bird's view of the wind and whether my conception of what the bird's view must be is correct.

NEIL T. McMILLAN
CAPTAIN, EASTERN AIR LINES

2130 Belvedere Ave., S.W.
Atlanta, Georgia

'STARLINGS AND WOODPECKERS'

EDITOR OF 'THE AUK':—

In 'The Auk' for January, 1943, p. 91, Mr. A. B. Howell describes the killing of young Downy Woodpeckers by Starlings: "A Starling with something in its beak approached the hole and appeared to dangle it temptingly at the entrance for a moment, before giving a mighty jab. This was repeated several times. Evidently it was trying to entice, with bait, a young downy within reach of a crippling blow by its beak."

Instead of crediting *Sturnus vulgaris* with deliberately planning such a 'diabolical' act, a simpler explanation of the observed behavior may be offered. Adult birds of various species have been reported carrying food to young of other species. The Starling, attracted by the food calls of the young Downies, takes food to the hole; the unfamiliar appearance of the nestling inhibits the feeding impulse and invokes a hostile reaction. One is reminded of Lorenz's example of the Muscovy Duck that responds to the distress cry of a Mallard duckling by defending it, but responds to its pattern of down by killing it as a nest enemy.

MARGARET M. NICE

5708 Kenwood Avenue
Chicago, Illinois

DR. STRONG'S 'BIBLIOGRAPHY OF BIRDS'

EDITOR OF 'THE AUK':—

Though the author-catalog of the "Bibliography of Birds" was published over three years ago (Field Mus. Nat. Hist., Zool. Ser., 25, parts 1 and 2, 1939), there has been unavoidable delay in the publication of the third and much larger volume, which consists mainly of subject- and finding-indices. Galley proof for subjects as far as "Locomotion" in the subject index was received in the summer of 1941, also 110 pages of page proof, which includes subjects as far as "connective tissue." Occasional requests have been received for information contained in these indices, and I am sympathetic with these efforts.

The finding-index cannot be finally arranged until all of the page proof has been produced. However, all of the items have been written, and they have been sorted for those subjects covered by the page proof received. As a topic may occur in various parts of the subject-index, the finding-index is essential. It is not feasible to attempt to locate at this time all of the references dealing with a topic. However, many can be located, especially those grouped in the subject-index.

I cannot take the time necessary to search through the manuscript of the subject-index or through the many thousands of slips which bear the finding-index items. However, I am willing to employ and direct a student to do what is feasible in collecting references to topics which may interest correspondents. Such service can probably be obtained for 50 cents an hour, and it should ordinarily not take more than a few hours to do what is feasible on any single topic. This expense would be charged to the correspondent. Care would be taken to avoid impracticable searching. My memory of the location of items would of course help.

R. M. STRONG

Loyola University School of Medicine
706 S. Wolcott Ave., Chicago, Illinois

NOTES AND NEWS

As this number goes to press, word has been received of the death of Rear Admiral Hubert Lynes, R.N., Honorary Fellow of the American Ornithologists' Union, on November 10, 1942, and of Dr. Leonhard Stejneger, Fellow Emeritus of the Union, at Washington, D. C., on February 28, 1943.

OBITUARIES

WILLIAM PLANE PYCRAFT, an Honorary Fellow of the American Ornithologists' Union, died May 1, 1942, at the age of 74. He was born in Great Yarmouth, England, on the east coast of the County of Norfolk in 1868, and at an early age became interested in the wild life of the Norfolk Broads. His work in natural history began as a pupil of the curator of the Leicester Museum. In 1892 he met Prof. E. Ray Lankester, then connected with the University of Oxford, who invited him to assist in making preparations for the museum. He attended Lankester's lectures and became more and more interested in zoology. When Lankester became Director of the British Museum of Natural History in 1898, Pycraft was made a temporary assistant and later received an appointment as an Assistant in the Zoological Department, a position which he retained until he retired in 1933.

Apparently his first paper, published at the age of 20, was a contribution entitled 'Ornithological Notes from the Neighborhood of Yarmouth,' which appeared in 1888 in the 'Transactions of the Norfolk and Norwich Natural History Society.' His early researches were devoted chiefly to the anatomy of birds. A paper contributed to 'The Ibis' in 1895 contained a discussion of the arrangement of the feathers in the tinamous, a memoir on the feathering of owls appeared in the 'Transactions of the Linnean Society' in 1898, and another on the 'Morphology of Palaeognathae and Neognathae was published in the 'Memoirs of the Zoological Society' in 1900. Later he became interested in the variations of the human skull and published accounts of the Boskop skull from South Africa, a skull from Rhodesia, and the skull of the Piltdown man from Sussex, England.

According to A. S. Woodward, Pycraft "had a versatile mind and was always interesting." He was a prolific author of popular articles and books on natural history and for many years he contributed a weekly article to the 'Illustrated London News.' Most of his papers on birds appeared in 'British Birds,' 'Bulletin of the British Ornithologists' Club,' 'Ibis,' and 'Proceedings of the Zoological Society of London.' His books included 'Stories of Bird Life,' 'Fish Life' and 'Reptile Life' (1900–1905), 'History of Birds' (1910), and 'Birds of Great Britain (1934). His presidential address before the Norfolk and Norwich Natural History Society in 1935, on 'Some New Aspects of Evolution,' was reprinted in the Annual Report of the Smithsonian Institution for 1936, pp. 217–241.

Pycraft was elected a member of the B. O. U. in 1893 and was also an Associate of the Linnean Society, a Fellow of the Zoological Society of London, and for 40 years a member of the A. O. U. He was elected a Corresponding Fellow in 1902 and, following the appearance of his 'History of Birds' in 1910, was made an Honorary Fellow in 1911.—T. S. PALMER.

MONTAGU AUSTIN PHILLIPS, a Corresponding Fellow of the American Ornithologists' Union, died in London, Jan. 11, 1939, at the age of 59. He was born in Hampstead, England, in 1879, and was educated at Kings College, London. For many years he was an assistant of J. H. Leonard, first guide lecturer of the British Museum of Natural History. On Leonard's death he succeeded to the position of guide lecturer. According to a notice in 'The Ibis' for 1939, p. 362, he was "a well known and popular lecturer to schools and societies all over the country. He had a charming descriptive manner in dealing with any subject, no matter how uninteresting it might appear. In addition to his knowledge of natural history, Phillips was a great lover of music and an accomplished performer on the organ."

He was elected a Corresponding Fellow of the A. O. U. in 1919 and a Member of the B. O. U. in 1920.—T. S. PALMER.

BARON RENÉ CHARLES EDUARD GEORGES JEAN SNOUCKAERT VAN SCHAUBURG, a Corresponding Fellow of the American Ornithologists' Union, elected in 1930, died at the age of 79, in Territet, Switzerland, August 20, 1936. He was born at The Hague, Holland, May 10, 1857, and attended school in that city from 1866 to 1869. In 1874 he became a student at the Academy in Leiden and in 1882 received his doctorate degree. At the time of his election to the Union he was living at Doorn, Holland, but two years later he moved to Brussels, Belgium, in 1924 back to Holland, and in the following year to Territet, Switzerland, which became his home during his remaining years.

He was the Founder of the Nederlandsche Ornith. Vereenigen in 1904 and the Club van Nederlandsche Vogelkundigen in 1911 and, for several years prior to his death, was Honorary President of the latter organization. In 1923 he was elected a Corresponding Member of the Deutsche Ornithologische Gesellschaft.

Part of his collection of birds, including about 400 of the rarer specimens, was given to the Museum van Artis in Amsterdam and 750 others were acquired by the Carnegie Museum in Pittsburgh. His collection of 1500 eggs of native birds was placed in the hands of A. A. van Pelt Lechner.

Baron Snouckaert was the author of a number of publications on birds, the more important of which were his 'Avifauna Neerlandica (1908),' and 'De Geog. Verbreiding der Pycnonotidae van Azie en den Indischen Archipel (1934–36).' A more extended account of his activities, accompanied by a portrait, may be found in the 'Orgaan Club Nederl. Vogelk.', 9: 97–102, Nov. 1936.—T. S. PALMER.

WHARTON HUBER, a Member of the American Ornithologists' Union, was born in Philadelphia, Pennsylvania, November 9, 1877, and died March 13, 1942, at his home in Chester County, in the same state. After early schooling at Penn Charter School he graduated from Lafayette College in 1901. From 1901 until 1906 Huber was on the staff of the Wister Institute of Anatomy, and various business interests then occupied his years until 1920, when he became associated with the Academy of Natural Sciences of Philadelphia, first as Assistant, and later Associate Curator of Birds and Mammals, under his old friend Dr. Witmer Stone, and from 1934 until his death as Curator of Mammals. A serious illness, which eventually proved fatal, caused him to withdraw from active curatorial work during the last few years.

From early life he was interested in birds and bird life, in mammals and wild flowers, and these continued dominant and absorbing fields through his years. In addition to being an excellent field ornithologist and mammalogist, he was a preparator *par excellence,* and a private collection of some thousands of skins of North American birds of exceptional preparation, largely assembled more than thirty years ago, attested his ability as an exponent of the ornithology of Elliott Coues. However, his interest in the protection of birds and other wild life was sincere and militant, and his courageous and outspoken condemnation of the blanket poisoning of small mammals and similar types of destruction of interesting forms of wild life was a personal characteristic. Unless a bird or mammal was to be preserved for scientific study he had no desire to take its life, and the broad acres of woods and fields of the home estate where he passed his last years, in the hills of northern Chester County, was in all truth a haven for the wild life of that neighborhood.

During his years at the Academy, Huber was the leader of its Nicaraguan Ex-

pedition of 1922, and he also made or took part in numerous other expeditions or surveys for the Academy to the Queen Charlotte Islands of British Columbia, Utah, Louisiana, New Mexico, Arizona, California and North Carolina. He was particularly interested in the southwestern United States, where he had spent many months both before and after his connection with the Academy.

While the list of Huber's publication is not great, and these were largely based on his own field studies, his store of knowledge of both birds and mammals was very extensive, and with it was combined all those attributes so greatly desired—and often sadly lacking—in a curator, *i. e.* preparatorial technique of high quality and capable of being readily imparted to another, a natural orderliness of detail and a deep regard for the preservation of full historical and vital data. One of his discoveries was the New Mexican Duck (*Anas diazi novimexicana*), also described by him.

In addition to being a member of the A. O. U., Huber was a member of the American Society of Mammalogists (which he had also served as a member of its Board of Directors), of the Cooper Ornithological Club, of the Delaware Valley Ornithological Club (which he also served as Vice-President and President), of the Zoological Society of Philadelphia, and of the Wilderness Club. He was active in the work of the Geographical Society of Philadelphia, long serving as a member of its Board of Directors, then as Vice-President and President. He was frequently a speaker before other organizations interested in the protection of wild life. The photography of wild animals and of native plants was a sustained interest through his life, and many of his pictures were of outstanding character.

In Huber's contacts with younger ornithologists he helped build a sustained interest, passing on an enthusiasm beyond the power of most other museum men. He gave to many of these beginners objectives and inspirations with an unpatronizing kindliness they will always remember.—James A. G. Rehn.

George Henry Mackay, a Member of the American Ornithologists' Union for many years, died in Boston, Massachusetts, January 16, 1937, at the advanced age of 93. He was born in Boston, October 20, 1843, the son of Robert Caldwell and Charlotte Langdon (Lodge) Mackay. He was educated in private schools and later was engaged in the East Indian importing business. Early in 1890 he joined the Nuttall Ornithological Club and later in the same year, at the meeting in Washington, he was elected an Associate of the Union. With the establishment of the class of Members in 1901, he was one of the first Associates advanced to that rank. In Batchelder's 'Account of the Nuttall Ornithological Club,' Mackay is described as "an ardent sportsman, who always had studied seriously the game he pursued, he had at that time [1890], in his early middle age, a remarkably full and intimate acquaintance with all the New England birds that frequent salt water. He brought a fund of knowledge none of the rest of us possessed. Deliberate and careful in his statements, yet a most genial companion, he was a great addition to our ranks."

Mackay was accustomed to do much of his shooting on the islands of Muskeget and Nantucket and, beginning about 1885, kept accurate records of his hunting. His election to the Nuttall Club and the Union seems to have stimulated his interest in putting his notes in shape for publication. Beginning in 1890, he published, during succeeding years, a series of about 75 articles and short notes on the sea and shore birds of the Massachusetts coast. In 1929 his shooting record was published privately by Dr. John C. Phillips under the title 'Shooting Journal of George Henry Mackay, 1865–1922,' with his portrait as a frontispiece. Unfortunately this

important record was issued in an edition of only 300 copies for private distribution and has become one of the rare books dealing with sport in America.

Mackay was always interested and active in bird protection. About 1897 he induced the people of Nantucket to continue the services of an officer to protect the terns on Muskeget Island and he also opposed efforts to change the existing law protecting the birds so as to allow taking their eggs for food. Certain species, such as the Arctic and Roseate Terns, were almost extirpated by hunters collecting skins for the millinery trade and, had it not been for this public spirited action, the colonies on this island might have been exterminated.—T. S. PALMER.

ARTHUR HERBERT NORTON, of the Portland Society of Natural History and Maine's outstanding naturalist, geographer and bibliographer, joined the American Ornithologists' Union in 1890 and was a Member from 1902 until his death on January 5, 1943. Born in the small coastal town of Saint George, Maine, on April 19, 1870, Mr. Norton was the son of Horace F. Norton, first captain of the White Head Island life-saving station, and Cynthia Elwell Norton, both of English ancestry.

As a small lad living on a coastal island, he had few playmates or diversions. It was his good fortune, however, to have a studious father interested in the local natural history and tolerant of his son's interests. The other men at the station knew the seafowl fairly well. This combination of circumstances was undoubtedly reflected in Mr. Norton's lifelong interest in sea birds and changing ecological conditions along the coast.

Writing about the early period of his life, Mr. Norton told of being fascinated, at the age of three or four years, by a collection of a dozen or less "stuffed" birds which his father, a "pioneer in bird stuffing in that locality," possessed. He recalled that no arsenic was used on the birds, so that when they were banished beyond the garden fence, he "swam them in a convenient puddle." An early treasure, presented him by his father, was a copy of Rev. J. G. Wood's 'Homes Without Hands.' Mr. Norton also recalled a neighbor, Mr. Fred Rackliff, who began to collect and mount birds in the late 1870's, and wrote that about 1880, "with one or two demonstrations from Fred Rackliff, I began to "stuff" birds, depending on the cat for victims." He was then ten years old.

Mr. Norton attended the public schools at Saint George and, while circumstances prevented him from getting a higher education in the academic sense, he developed, during his lifetime, the breadth and disciplines of a true scholar by such tasks as learning Latin by himself to aid him in his scientific studies.

In 1885, the family moved to Westbrook, near Portland, and Mr. Norton took up the trade of silk weaver. By 1888 he was actively engaged in building up an ornithological library and collection. Undoubtedly he was much encouraged in this by the active group of bird students in the Portland region at that time. Close friends included Everett Smith, whose list of birds of Maine appeared in 'Forest and Stream' in the early 1880's; Nathan Clifford Brown, a Founder of the Union, whose biography Mr. Norton prepared for 'The Auk' (1942: 471–476); Professor Leslie A. Lee of the Biology Department at Bowdoin College; Major John M. Gould and Mr. Jed F. Fanning of Portland. His botanical interests were encouraged by Miss Kate Furbish of Brunswick.

At about the time of the Spanish-American war and in the year before his marriage in 1899, Mr. Norton made a trip to South Carolina to collect Linnaean topotypes. Landing at Port Royal, he shortly had to prove that he was not a spy, having taken photographs on a government reservation. While the trip was suc-

cessful, it was later learned that Outram Bangs was working along the same lines and the latter's results were made ready for the press first. Other trips outside of Maine were usually brief and never for purely scientific study.

In 1905, Mr. Norton succeeded Dr. Charles B. Fuller at the Portland Society of Natural History, as Curator. At this time he was already well established as an authority on the flora and fauna of Maine and had been publishing papers for a decade.

During the thirteen years of the existence of the 'Journal of the Maine Ornithological Society' (Jan. 1899–Dec. 1911), Mr. Norton contributed 40 short articles, beginning in April, 1899. He not only actively supported and contributed to the 'Maine Naturalist' while it was published (1921–1930), but also edited it and supervised the printing from 1927 to 1930. He published a number of bird papers in the 'Proceedings of the Portland Society of Natural History,' of which perhaps the most outstanding was that on 'Birds of the Bowdoin College Expedition to Labrador in 1891' (Vol. 2, art. 8: 139–158, 1901), in which he described the Large-billed Puffin. Between July, 1893, and October, 1942, there appeared 51 titles by him in 'The Auk,' mostly short papers and notes. He contributed reports and papers to 'Bird-Lore,' 'Proceedings of the Essex Institute,' and elsewhere. His botanical writings consist chiefly of 12 titles in 'Rhodora' (1902–1939, inclusive), papers in the 'Maine Naturalist' and publications of the Josselyn Botanical Society. During his curatorship, the Society's herbarium came to number over 40,000 specimens, much of it collected by himself. His 'Mammals of Portland, Maine, and Vicinity,' published in the Society's 'Proceedings' in 1930, is undoubtedly the best local list of mammals for the state. He wrote two papers on Maine herpetology. With reviews, editing of bibliographies, and miscellaneous writings, his total contributions numbered over 200 titles. It is to be regretted that he was unable to finish his manuscript, comprising over 40-years' research and compilation of data on the birds of Maine.

A study of the literature of Maine ornithology of the present century lends strong support to the conclusion that Mr. Norton was reticent about publishing his own findings, since for every title in print by him one can find an average of over five by others in which the authors acknowledge indebtedness to him for assistance rendered. His files were always kept up to date, he was in the field a great deal, and he knew of everyone who ever had even a passing interest in Maine natural history. His file of biographical material was of special value to younger students who wished to learn about early authors. The result of his labors was that almost every serious naturalist who worked in Maine would seek him out and profit by the association. As was to be expected, many came to depend upon him for advice and corroborative material when preparing a paper for publication—be the subject on meteorology, shell-heaps, botany, history, biography, or any branch of zoology. As an example, in a letter to the memorialist about a decade ago, he expressed regrets that the season had been so dry and unfavorable that he could not carry out a contemplated study of land snails. He was the all-around field naturalist of a type now nearly non-existent.

A revealing example of the discerning and investigative nature of his mind is found in the fact that he realized a need for keeping careful weather records, especially in connection with his migration studies. He purchased a Taylor thermometer and kept records over a period of years. When the Portland weather station was moved from its former unsuitable site to the present one, Mr. Norton's

careful temperature records for the preceding period were accepted as official for the Portland region.

Mr. Norton was a corresponding member of the Philadelphia Academy of Natural Sciences and the New England Botanical Club, secretary of the Maine Ornithological Society, at various times president and secretary of the Josselyn Botanical Society, member of the Wilson Ornithological Club, and charter member of the American Society of Mammalogists. He was very active in the Audubon Society of Maine (founded in 1902), his first report as secretary appearing in the November–December issue of 'Bird-Lore' for 1906, and was field agent for Maine from 1914 to 1934, and a member of the Board of Directors of the National Association of Audubon Societies for the years 1905–1908.

Public recognition for "significant scientific studies which have added to our knowledge of Maine's natural history," came in June, 1940, when the University of Maine conferred upon him an honorary degree of Master of Science. Later, after a serious illness in May, 1942, forty-five friends presented him with a token of appreciation on Thanksgiving Day, accompanied by a testimonial of admiration and esteem which pointed out, in part, that he not only had "acquired the difficult art of observation to a degree attained by few" but had also recorded these observations "in brief and plain language for all posterity."—RALPH S. PALMER.

EMMA GERTRUDE CUMMINGS, an Associate of the American Ornithologists' Union since 1903, died at Westfield, Massachusetts, October 12, 1940, at the age of nearly 84. A month before, she had attended the closing session of the Union in Cambridge and at the time of her death she suffered a heart attack while on a botanizing trip. She was born in Cambridge, December 2, 1856, and most of the later years of her life were spent in Brookline. Her education was received in Boston private schools and in the Boston Art School.

With Miss Harriet E. Freeman she joined the A. O. U. excursion to California in 1903 and both were elected Associates at the meeting in San Francisco. Later, about 1915, they visited the Orient together and made a trip around the world. She was a good botanist, keenly interested in dendrology, birds and bird protection and took an active part in local civic affairs. For forty years she was a member of the 'Committee on Planting Trees' and was the first woman elected to the office under a special amendment enacted by the legislature, in 1900, to a law which previously prohibited women from holding any elective office in Brookline except that of a member of the school committee. She was the last surviving member of the original Copley Society of Boston and one of the first members of the Tuesday Club of Brookline.

Miss Cummings was author of a 'Baby Pathfinder to the Birds,' 'Brookline Trees,' and a map of the more important trees of Brookline. While she published nothing in 'The Auk' and took no active part in the discussion of papers on the program, she and Miss Freeman attended the meetings of the Union whenever possible and in a quiet way participated in the entertainment of visiting members. As long as Miss Freeman lived they were traveling companions and visited many places together. Both were representatives of the highest type of lady members who form one of the mainstays of the Union by holding their membership over a long period of years, attending the meetings, extending its influence by securing new members and aiding in every possible way in the work of the organization. Miss Cummings was survived by two sisters, Miss Mabel H. Cummings, principal of the Brimmer

and May School, and Miss Harriet Alma Cummings who died in November, 1941. —T. S. PALMER.

EDWARD GRUET KENT, an Associate of the American Ornithologists' Union for nearly twenty-one years. died at Madison, New Jersey, March 24, 1940, in his 65th year. He was the son of Stephen Baldwin and Anna G. (Gruet) Kent and was born at Newark, New Jersey. He received the degree of B.S. from Princeton University in 1897. From the time of his graduation until September 1, 1939, when he retired, he was connected with the Public Service Electric and Gas Company.

Kent's scientific interests were in two fields—ornithology and archaeology. He was the owner of an extensive ornithological library. In 1925 he published a pamphlet on the birds of Madison (N. J.) and vicinity. He had a large archaeological collection gained in the study of the Southwest and the American Indian.

In addition to holding membership in the Union, Kent was a member of the Archaeological Society of New Jersey, of which he was a vice-president, the American Archaeological Society, the New Mexican Archaeological Society, the Arizona Society of Science and Art, and the Museum of Northern Mexico.—WILLIAM F. RAPP, JR.

JOHN SMITH MAIN, an Associate of the American Ornithologicts' Union, elected in 1926, died in Madison, Wisconsin, November 13, 1940. He was born in that city November 23, 1875, graduated from the law school of the University of Wisconsin in 1900, and subsequently entered the real estate and insurance business. A mutual friend informed me that following graduation he and Main frequently read poetry together. This taste left its impress on some of his writings, particularly that on the dance of the Prairie Chicken.

A sustained interest in ornithology was not acquired until rather late in life. As is sometimes the case, this lapse was distanced by intensive study and field work. Every bird in a marsh was subjected to scrutiny and due to meticulous survey, more unusual discoveries were made than fall to the lot of the average student. One of the prominent traits of his pleasing personality was enthusiasm, and on the day that a Cinnamon Teal was taken, he drove forty miles to show the specimen to friends.

Mr. Main was one of the founders of the Kumlien Club and served as its president. After The Wisconsin Society of Ornithology was established, he gave it active support as a member of the executive committee. He entered the field at a time when interest in ornithology in Wisconsin was at a low ebb, and one of his most important contributions was the effort made to place the study of birds in the state on a lasting foundation.—A. W. SCHORGER.

EDWARD NORRIS, an Associate for 25 years and an active Trustee of The American Ornithologists' Union, died January 14, 1941. Born at Chestnut Hill, Philadelphia, on July 27, 1868, Mr. Norris, throughout his life, was an ardent amateur naturalist with ornithology as his primary interest. Residing, as he did, near the banks of the Wissahickon Creek, he was a keen observer of the areas surrounding that stream and the adjacent White Marsh valley. It was while hunting grouse in Monroe County, Pennsylvania, on October 23, 1895, in company with his brother, that the latter shot the last recorded Passenger Pigeon in this state—a male in perfect plumage. A member of the Delaware Valley Ornithological Club and a close friend of Witmer Stone, he accompanied the latter on many rambles in and about Cape May where Norris also spent many of his summers in late years.—GEORGE H. STUART, 3RD.

THE AUK

A Quarterly Journal of Ornithology

ORGAN OF THE AMERICAN ORNITHOLOGISTS' UNION

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